

JOURNAL

OF THE

NEW YORK

ENTOMOLOGICAL SOCIETY

Devoted to Entomology in General

Volume XX, 1912

EDITED BY WILLIAM MORTON WHEELER

NEW YORK

PUBLISHED BY THE SOCIETY

QUARTERLY

1912

22555

PRESS OF
THE NEW ERA PRINTING COMPANY
LANCASTER, PA



CONTENTS OF VOLUME XX.

ALDRICH, J. M.,	
Larvae of a Saturniid Moth used as Food by California Indians	28
The Biology of Some Western Species of the Dipterous Genus <i>Ephydria</i>	77
Two Western Species of <i>Ephydria</i>	99
ALEXANDER, CHAS. P.,	
A Revision of the Genus <i>Brachypremna</i> Osten-Sacken... .	225
ALEXANDER, C. P., AND LEONARD, M. D.,	
Venational Variation in <i>Cladura</i>	36
DAVIS, WM. T.,	
Notes on the Distribution of Several Species of Tiger Beetles	17
Three New Species of <i>Belocephalus</i> from Florida.....	122
DAVIS, WM. T., AND LENG, C. W.,	
Insects on a Recently Felled Tree.....	119
FALL, H. C.,	
A Revision of the North American Species of <i>Collops</i>	249
FELT, E. P.,	
New Itonidæ	102
New Gall Midges or Itonidæ.....	146
Studies in Itonidæ	236
FENYES, A.,	
<i>Falagria</i> Mann. and Its Relatives	20
FULLAWAY, DAVID T.,	
Gall-Fly Parasites	274
GIRAUULT, A. A.,	
The Occurrence of the Mymarid Genus <i>Stephanodes</i> Enock in North America	40
GROSSBECK, JOHN A.,	
Miscellaneous Notes and Descriptions of North American Geometridæ	282

KNAB, FREDERICK,	
Diptera at Home on Spiders' Webs.....	143
LENG, CHAS. W.,	
The Geographical Distribution of Cicindelidae in Eastern North America	1
MATAUSCH, IGNAZ,	
Observations on the Life History of <i>Enchenopa binotata</i> Say	58
MATHESON, ROBERT,	
The Haliplidae of North America, North of Mexico.....	156
NEWCOMER, E. J.,	
Some Observations on the Relations of Ants and Lycenid Caterpillars and a Description of the Relational Organs of the Latter	31
OLSEN, CHRIS. E.,	
Contribution to an Annotated List of Long Island Insects. 48	
TOWNSEND, CHARLES H. T.,	
Foundation of Some New Genera and Species of Muscoid Flies Mainly on Reproductive and Early-Stage Characters. 107	
WEBSTER, R. L.,	
The Number of Moult's of the Pear-Slug <i>Caliroa cerasi</i> Linn.	125
WHEELER, WILLIAM M.,	
The Ants of Guant.....	44
Notes on a Mistletoe Ant	130
Miscellaneous Notes	67, 134, 193, 292
Book Notice	195
Proceedings of the New York Entomological Society, 71, 136, 197, 295	

VOL. XX.

NO. I.

JOURNAL
OF THE
NEW YORK
Entomological Society.

Devoted to Entomology in General.



MARCH, 1912.

Edited by W. M. WHEELER.

Publication Committee.

CHARLES SCHAEFFER.
F. E. LUTZ

R. C. OSBURN.
W. M. WHEELER

Published Quarterly by the Society.

LANCASTER, PA.

NEW YORK CITY.

1912.

[Entered April 21, 1904, at Lancaster, Pa., as second-class matter, under Act of Congress of July 16, 1894.]

CONTENTS.

The Geographical Distribution of Cicindelidæ in Eastern North America. By CHARLES W. LENG	1
Notes on the Distribution of Several Species of Tiger Beetles. By WM. T. DAVIS	17
Falagria Mannh. and its Relatives. By A. FENYES	20
Larvæ of a Saturniid Moth Used as Food by California Indians. By J. M. ALDRICH	28
Some Observations on the Relations of Ants and Lycænid Caterpillars, and a Description of the Relational Organs of the Latter. By E. J. NEWCOMER	31
Venational Variation in Cladura (Tipulidæ Diptera). By C. P. ALEXANDER and M. D. LEONARD	36
The Occurrence of the Mymarid Genus Stephanodes Enock in North America. By A. A. GIRAULT	40
The Ants of Guam. By WILLIAM MORTON WHEELER	44
Contribution to an Annotated List of Long Island Insects. By CHRIS. E. OLSEN	48
Observations on the Life History of Enchenopa binotata Say. By IGNAZ MATAUSCH	58
Miscellaneous Notes	67
Proceedings of the New York Entomological Society	71

JOURNAL

OF THE

New York Entomological Society.

Published quarterly by the Society, at 41 North Queen St., Lancaster Pa., and New York City. All communications relating to the JOURNAL should be sent to the editor, W. M. Wheeler, Bussey Institution, Forest Hills, Boston, Mass., all subscriptions to the Treasurer, Wm. T. Davis, 146 Stuyvesant Place, New Brighton, Staten Is., New York, and all books and pamphlets to the Librarian, C. Schaeffer, Museum, Eastern Parkway, Brooklyn, N. Y. Terms for subscription, \$2.00 per year, strictly in advance. *Please make all checks, money-orders, or drafts payable to NEW YORK ENTOMOLOGICAL SOCIETY.*

Authors of each contribution to the JOURNAL shall be entitled to 25 separates of such contribution without change of form. If a larger number be desired they will be supplied at cost, provided notice is sent to the Editor before the page proof has been corrected.

JOURNAL
OF THE
New York Entomological Society.

VOL. XX.

MARCH, 1912.

No. 1.

THE GEOGRAPHICAL DISTRIBUTION OF CICINDELIDÆ IN EASTERN NORTH AMERICA.¹

BY CHARLES W. LENG,

WEST NEW BRIGHTON, N. Y.

INTRODUCTION.

My special interest in the tiger beetles dates from the time when Schaupp was writing his Revision in 1883, at which time I, as his pupil in German and entomology, was permitted to watch the progress of his work. That interest, always continued, received a special impetus from the publication of Professor Wickham's "Habits of American Cicindelidæ" in 1899, and I commenced to gather data in regard to habits and distribution and to view the subject from other standpoints than the purely taxonomic one from which my 1902 Revision was mainly prepared. With the advent of Dr. Lutz, considerations of the environment and evolution of our insects have been constantly kept before us, and have assumed an importance in our discussions that is largely responsible for the preparation of this paper. In the meantime also, the great work of Walther Horn which has been partly published in *Genera Insectorum*, the investigations of Norman Criddle and of Victor E. Shelford on the larvæ, the zealous collecting of Warren Knaus and others, have all tended to uncover hidden facts; and finally the untiring labors of our fellow member, Edward D. Harris, have culminated in the publication of his "Catalogue," in which the distribution of the species in his collection is minutely stated. So that it

¹ Annual Address of the President.

is now possible to give the complete distribution of our species with reasonable accuracy and to discuss the causes that have produced it. Such is the subject I shall attempt to treat in this paper.

TAXONOMY.

Before taking up the distribution of our species let me briefly sketch the classification and distribution of other Cicindelidae in order to emphasize the small portion ours constitutes of the whole subfamily, for the Cicindelidae are now regarded as merely a subfamily of Carabidae. The subfamily is divided into five tribes, viz.: Ctenostomini, Collyrini, Mantichorini, Megacephalini, and Cicindelini, of which two, Collyrini and Mantichorini, are confined to the old world and do not at present concern us at all. A third tribe, the Ctenostomini, are confined to tropical climates, some species occurring in Yuentan, but none has so far come nearer to the southern limit of the United States. So that our interest centers in the tribes Megacephalini and Cicindelini. The former is represented by several South American genera, *Eucallia*, *Orychila*, *Chiloxia*, *Pseudorychila* and *Aniaria*, of which Mr. Harris has been kind enough to bring specimens for your examination. These genera extend for varying distances north of the isthmus of Panama, one reaching Honduras, another Costa Rica, but none attaining as yet the United States. The Megacephalini include also the species of *Omus*, confined to the Pacific Slope; the species of *Amblychila*, confined to the Sonoran region; and the species of *Tetracha* which are numerous, and covering nearly all the territory occupied by other members of the tribe, extend also beyond that territory and are found in the Antilles and in our southern states north to Cincinnati, Ohio, fide Dury, and Central Park, Long Island, where, as you know, a single specimen has been found by Mr. Davis. There remains to consider the fifth tribe Cicindelini; this, too, consists of several genera besides *Cicindela* proper, of which the South American *Euprosopus*, *Oxygonia*, *Odontochila* and *Prepusa* are represented in the box prepared by Mr. Harris of these genera. I know of no Central American species except *Odontochila* of which Mr. Harris has received a specimen taken in the state of Sonora, Mexico. *Cicindela* is therefore, though an important genus with us, only one genus in a large tribe and that tribe is only one of the five into which the subfamily is divided. The importance it assumes in our lists is greater than that to which it becomes entitled among the Cicindelidae of the world.

Within the genus no proposed division has been generally accepted; but it is evident that two groups can be readily distinguished, the one containing the long-legged species in which the subapical margin of the elytra is often more or less emarginate and the mandibles more or less toothed, and the short-legged species in which such modifications of the elytra and mandibles do not occur. Other characters like the long labrum of *longilabris*, the form of the clypeus, and of the thorax, the pilosity and punctuation of the surface serve to separate species, but the important group character seems to me now to lie in the length of the legs. In the box, to which I have already referred, of South American forms you will see some of these long-legged forms which occur also in the West Indies, in Central America, in our Southern States, and represented by a few species even north to Massachusetts and Maine.

In concluding this brief reference to the different tribes and genera I wish to repeat and emphasize the northward procession of the family with numerous genera in South America, fewer in the Antilles and Central America, four only in the United States, with a corresponding procession of the long-legged species of *Cicindela*, diminishing in number northward, until *marginata* alone remains to represent them on the coast of Maine.

FACTORS CONTROLLING DISTRIBUTION.

Merriam's Zones.—Many considerations involving the causes of the distribution observed for different species of plants and animals have been advanced and each doubtless has its bearing upon the problem. The work of Merriam in defining certain zones based largely on the isothermal lines has been widely adopted as the exponent of the influence of temperature. In his pamphlet "Life Zones and Crop Zones of the United States" the Atlantic Coast is divided into tropical, gulf-strip, lower austral, upper austral, transition, and boreal. His map shows the meaning of these terms more plainly than any description I could give and you will note how irregular the lines become on leaving the coast, the colder zones descending far southward in the mountains, while the warmer zones, shown by yellow color, creep northward along the rivers like the Hudson and the Susquehanna. In the box I have prepared, colors corresponding to those shown on Merriam's map have been used to indicate the zones and

the specimens have been inserted in the zone within which they occur in nature. Each vertical line of specimens contains one species. At a glance you perceive how few species penetrate the boreal zone, indicating perhaps the inability of the others to live under its cold conditions; but you will also observe that the bulk of our species occur in several zones. Not always however without some modification in the different zones. Compare the dark *12-guttata* of Lakehurst, N. J., with the bright green specimen from Cape Breton, or the little *dorsalis* of Florida with the much larger specimen from Massachusetts, and you will realize the modifications that do occur. The most marked example is in *tranquebarica* and here the forms due apparently to climatic differences have received varietal names, the southernmost form being called *vulgaris-minor*, reduced in size and dark with narrow lines, the northernmost, *horiconensis*, large, brilliant metallic, with broad lines. Again in *repanda* and *punctulata* you see instances of the contrary where the species unmodified live in several zones. Thus it is evident that the influence of temperature in controlling distribution and in modifying color is one of the factors but not the absolute and only factor.

Akin to temperature as controlled by latitude is temperature as controlled by elevation, but as the mountain slopes which produce the latter also introduce other conditions, the differences that have been observed between lowland and mountain forms of the same species cannot be surely ascribed to temperature. The modification of *6-guttata* described as *harrisii*, the modification of *longilabris* described as *oslari*, and other similar modifications apparently resulting from elevation can only be doubtfully referred to the influence of colder temperature; it may however be significant that a more brilliant color results equally from high latitude and high elevation. An interesting case, when sufficiently confirmed, may be found in *longilabris* in Newfoundland, which near the sea-level is dark bronze, but in the mountains of the west coast, as indicated by three specimens only, is bright green.

Leconte's Districts.—Leaving the question of temperature and latitude and the Merriam zones, all of which on the Atlantic coast mainly control distribution north and south, let us consider the ideas of Dr. Leconte, which while they did not disregard the evidently boreal character of many species and the southern limit to the distri-

bution of others, brought into much greater prominence the importance of the mountain systems as factors controlling distribution east and west. In the introduction to the "Coleoptera of Kansas and Eastern New Mexico" Leconte divided the United States roughly into four or five parts: one, Pacific, lying west of the Sierra Nevada; one, between it and the Rocky Mountains; one, central, between the Rocky Mountains and the Mississippi Valley, and one, eastern, itself feebly divided by the Appalachian range. The map illustrating his idea was printed in 1859 and allowances must be made for the imperfect data, due to its early date, upon which it was based in comparing it with Merriam's. To illustrate its bearing upon the known distribution of Cicindelidæ I would point out that the Pacific district is the exclusive home of the genus *Omus* and that every single *Cicindela* found there is either a species confined to that district or a named variety abundantly differentiated from its nearest relative east of the Sierra Nevada. The district between the Sierra Nevada and the Rocky Mountains is equally rich in peculiar forms. If it is true that the barrier created by the Sierra Nevada and that caused by the Rocky Mountains are factors in distribution, it should follow at least to some extent in the case of the Appalachian range. To test this I have arranged an east and west series of specimens of our *gencerosa*. A division caused by the Appalachian range is at once apparent. Observe that the middle band is always rectangularly bent in the specimens east of the Appalachian range, almost transverse in the western specimens which at the same time exhibit great variation in color. The names *formosa* and *manitoba* have been applied to them and to be consistent a name should be provided for our constant eastern modification. I have noticed the barrier constituted by the Appalachian range in other families resulting in slightly differentiated forms east and west and cannot but feel that Dr. Leconte's early ideas have been too long neglected. As the Merriam zones represent a factor operating north and south, the Leconte districts represent another operating east and west and with approximately equal force.

Environment.—Totally distinct from latitude and longitude is the factor of local environment, the character of the soil, its slope, the surrounding vegetation, moisture, exposure, etc. To remind you that *dorsalis* is always found on the seashore, *rugifrons* and *modesta* usually in the pine barrens is all that is necessary to illustrate the

importance of this factor; indeed its bearing upon problems of distribution is so evidently weighty that one is apt to question whether latitude has any influence except as it affects environment. In the case of *dorsalis*, itself a marked example of an insect clinging to one environment, I have already shown that while the beach sands are necessary to the creature's existence, and finding such sands along the coast from the Gulf of Mexico to Massachusetts, it has extended its range that far north, crossing four zonal boundaries in its northward journey, yet it has not preserved an unchanged identity in so doing but passes through the variations called *saulcyi*, *media* and *semipicta*. Conceding the great importance of environment, I must still maintain that like the factors previously considered it is only one of many affecting distribution.

In this connection I should point out the various observations of many collectors on the soil and other characteristics of the localities in which the different species occur. Locally it is well known that *dorsalis* lives on the sea beach, *hirticollis* and *levida* on the looser sands back of the beach, the latter also on loose white sand inland, *marginata* on mud flats, all more or less maritime; while an entirely different set of species inhabit the sandy pine barren plains, *rufifrons*, *modesta*, *consentanea*, etc.; it is also known that while a species like *repanda* may be found in a variety of semi-moist situations, *tz-guttata* can be expected only on the still more moist soil adjoining water and *purpurea* and *scruguttata* only on grassy hills or the latter in deciduous forests, at least locally. Each species in short seems to require a special environment and to insist upon it with a rigor that is in inverse proportion to its abundance.

Moisture.—In dealing with the distribution of the tiger beetles of our western states a special emphasis would have to be laid upon the influence of moisture; indeed in Dr. Leconte's division of the country into districts one is based upon the difference between the dry plains lying east of the Rocky Mountains and the more fertile country bordering the Mississippi River. Also in the same connection, the fauna of the saline lakes would require special consideration; but in the eastern parts of the United States, these matters do not present sufficient diversity to constitute important factors.

Behavior.—The meaning of these peculiarities has been traced back to the larval history of several species by Norman Criddle in

Manitoba and by Victor Shelford in Chicago. Showing first that the imago does not wander far from the larval home, Criddle has recorded patient investigations of the larvæ, describing the burrows they make in the soil, the nature and slope and moisture necessary for each species observed and the length of time passed in the larval and pupal stages. Shelford, repeating Criddle's observations, has studied the species living on the shores of Lake Michigan where varied conditions of slope, forest and moisture are found, and has determined experimentally the insistence of each species upon its customary environment. A female *limbalis* for instance, knowing that her larva will require sloping soil of a certain degree of moisture, will not oviposit in loose sand. A female *6-guttata* will oviposit only in what Shelford, following Cowles, calls climax forest, composed of beech, oak and other deciduous trees.

The bearing of these facts upon distribution is of great interest for if the female flies only from one suitable habitat to another, and cannot or will not fly to any great distance, it follows that any considerable interval of unsuitable soil will act as a barrier and retard the distribution of the species, even when suitable habitats exist beyond the barrier. If the intervening unsuitable territory is sufficiently extended, it may even serve to isolate the favorable habitat as completely as if it were an island in the ocean. This I conceive is the case in actual experience with *rufiventris* in the east plains of New Jersey. There with the adjoining west plains, which I have not seen but assume to be similar, is a peculiar piece of territory, in which Mr. Davis and I found gravelly hills about 100 feet above sea level in the midst of pine barrens. The very porous nature of the soil and its slope conspire to produce so dry a condition that ancient oaks are only 18 inches in height and the tallest pine tree we found was four feet in height. In this situation lives a species, *rufiventris*, not found elsewhere in New Jersey. Should the female wander from these hills to oviposit, she could not find a similar locality in the entire state and so year after year, century after century, *rufiventris* goes on inhabiting this small piece of the earth apparently a prisoner forever. The same appears to be the case with *hentzii* confined to certain dry hills in eastern Massachusetts and with some western species.

Adaptability.—With every other factor equal there still remains one that has evidently played an important part, *i. e.*, the adaptability

of the species to changing environment; *tranquebarica* and *longilabris* appear to have had a similar history, both driven far south during the glacial period, both returning northward with its retreat, both strong species represented by numerous varieties and abundant wherever they occur. But the one has survived the changing climate southward and continues to thrive in the austral zone as well as in the transition and boreal; while the other, *longilabris*, though it must have been driven far south of this latitude during the ice age, except on the probable assumption that it survived the ice age exclusively in isolated, northern, sheltered localities, has failed to survive even in the mountains and is now strictly confined to the boreal zone, having perished elsewhere as the temperature increased. The only cause I can imagine is that *tranquebarica* could and did adapt itself to the growing warmth of the Carolinas, Georgia and Louisiana and survives, while *longilabris* could not and so perished. It had the same chance but could not take advantage of it.

Accidents.—So powerfully deterrent to extended distribution is the influence of environment combined with the wilful behavior of the insects themselves that the marvel would be that many have spread so far were it not for the results of another set of factors that my friend Chas. R. Plunkett, who was with us at the last meeting, summarized under the name accidents, meaning thereby winds, currents, human interference, geological changes, anything acting independent of or contrary to the will of the insects. The widespread distribution of *punctulata*, flying as it does to lights at night and thereby exposing itself to the action of wind, and capable moreover of making itself at home in any garden path, is a case in point. The occurrence of *puritana* at widely separated points on the Connecticut River is another, for the gravid female could be carried as well by the river current in the one case as by winds in the other. In the case of our maritime species it is equally easy to conceive of the action of tides and storms providing the accidents that assisted in the dispersal of the species.

Dipping for a moment into the geological history of our continent we find readily enough stupendous accidents that must have profoundly influenced the distribution of our tiger beetles. I will refer however to but two, the glacial period and the former connection of this continent and Siberia.

During the glacial period everything on the Atlantic coast north of this latitude was covered with ice and snow and the climate immediately south of us must have been materially colder. Previous to the glacial period an opposite condition prevailed; the climate far to the north was temperate, forests flourished north of the present Alaska, and a comparatively warm British America was connected with an equally warm Siberia. The accidents of tide and wind and current, of elevation or subsidence of coastal plains, even of volcanic eruption are as nothing compared with the accidents to which tiger beetles were exposed before and during the glacial period. One can conceive of nothing to prevent the distribution of species from one continent to the other while they were connected. Even now we hear of circumpolar species, then each and every species may have been circumpolar in its distribution, displaying only such varieties from the opposite ends of its range as we find now in the *tranquebarica* of eastern and Pacific America. Then came the ice age, covering the north land with ice and snow, leaving possibly an always unglaciated area, as indicated in the map of Salisbury and Chamberlain, in Wisconsin extending northward into British America and perhaps other smaller unglaciated areas elsewhere, with alternating periods of extreme cold and milder climate, driving the tiger beetles south, then allowing them to return, then driving them south again, over and over again. At least three such alternations are traced by geologists. Need we be surprised if some species were exterminated and others nearly so? Would not naturally some survive the ice age as isolated remnants of a once far spreading species? And with the barriers I have indicated to their dispersal might they not to this day exist as isolated colonies? Compare with this theory the actual distribution of *ancocisconensis*, White Mountains of New Hampshire, De Bruce in Sullivan Co., N. Y., Cazenovia Creek near Buffalo, N. Y., and the mountains of West Virginia, four isolated stations with no localities known between. Compare *marginipennis* living on the mountainous banks of the Delaware River at Callicoon, N. Y., and the similar banks of the Susquehanna River in Pennsylvania. Compare *leptida* found in Manitoba, Nebraska and vicinity of New York City. All understandable as remnants of glacier tormented species but on no other theory that I have ever heard advanced.

Origin.—I do not mean to imply that for all the species men-

tioned a circumpolar distribution must be assumed as an original condition. In that respect I have especially in mind *longilabris*, *12-guttata* and *purpurca*, because each of these has an existing prototype in Siberia or Europe. On the contrary after considering many of our species as emigrants from South America, and others as survivors of former circumpolar forms, there remains a residue which indicate in their characters no close relationship with the species of other countries and must be regarded as originating with us, at least in comparatively recent time. Such is evidently the case with the genera *Omus* and *Amblychila*, both peculiarly our own and such also I conceive to be the case with those of our species which do not range far enough north to indicate original circumpolar relations or far enough south to indicate South American affinities. Such for instance as *rufiventris*, *hirticollis*, *ancocisconensis*, *marginipennis*, and surely *levida* and *generosa*. It is as reasonable to assume a North American origin for some species as a South American for others and most unreasonable to assume that the one region could have originated all and the other none. This subject has been in my mind ever since a happy discussion in 1902 between Mr. Schaeffer, Dr. Horn and myself, in which Dr. Horn held strongly to the idea of a South American origin, undoubtedly true as to many but I am convinced not as to all.

In speaking of the origin of these species I do so in the sense of their contemporaneous origin from preglacial species of the same genus, delving into their comparatively recent history, rather than into the first appearance of the genus on our earth. The evidence afforded by the fossil Coleoptera of the Don beds near Toronto, in which I understand many species are or may be referred to existing genera, would not suggest that great structural changes have taken place in tiger beetles since the glacial epoch; and such similarities in maculation as we observe in the European *caucasica* and our own *hirticollis*, bearing in mind the former connection through Siberia, may even suggest that in color and maculation little change has taken place.

The assumption of a South American origin for part of the species, and of a circumpolar origin for the remainder, part of the latter attaining their present characters on this continent before the ice age, part roaming over this continent and Eurasia, would imply

either that the northern forms originated long ago from the South American and became entirely separated from them during or prior to the Tertiary period, or would suggest that the long-legged South American forms and their North American relatives actually constitute a separate genus of different origin and with other characters (as in the mandibles and elytra) to differentiate it from the true *Cicindela* of the old world with which our northern species are for the most part related. Such a division of the genus has in fact been made though not at present generally adopted. The distribution of *Cicindela*, thus restricted, would then be in harmony with that of many other genera of Carabidae, the family of which the Cicindelidæ are now considered a subfamily.

Recapitulation.—I have now sketched and illustrated what I conceive to be the principal factors controlling distribution of Cicindelidæ on the Atlantic Coast, viz.:

Temperature as indicated by Merriam's zones,

Barriers as indicated by Leconte's districts,

Environment, etc., as brought out by Criddle, Shelford and others and including the behavior and adaptability of the species,

Accidents of wind, tide and geological changes, and

Original Habitat of the species. I propose below to examine the distribution of each species as given in Mr. Harris's Catalogue to see if the factors named are sufficient to account for the ascertained localities, dividing the species into three groups, viz., those assumed to be of circumpolar origin, those assumed to be long established in the United States, though originally derived from the same stock as the species of the first group, and those assumed to be of southern origin, mainly the long-legged species.

SPECIES OF CIRCUMPOLAR ORIGIN.

C. longilabris, including the varieties *laurenti*, *oslari*, *montana*, *vestalia*, *perviridis*, is strongly differentiated by the form of the labrum, a character it shares with the Siberian *silvatica*, which it also resembles in other respects. It inhabits the boreal zone from ocean to ocean, reaching 58° N. Lat. in British Columbia and on the Atlantic coast is found in Newfoundland, Nova Scotia, Maine, in the White Mts. and in the Adirondacks. It possesses great vitality and capacity for variation but seems quite unable to accommodate itself to the

warmer climate of the transition zone. It seems plainly a circum-polar species driven south by the glacier but returning immediately to the colder climate as the glacier retreated. Where it has been found by my friends it has been on hard beaten paths, on stony banks at some distance from water, on the road above tree line on Mt. Washington, on bare rocks at Mt. Desert, Maine. The great number of varieties into which it divides are in keeping with the idea of various colonies isolated at different times by the alternating glacial action and developed since glacial times in their present isolated homes. Its failure to establish a home in the Catskills for instance, over which it must have roamed at some time during the retreat of the ice, is accounted for by its lack of adaptability.

C. 12-guttata, distinguished from other species by its more depressed form, has also an allied species in the old world, and like *longilabris* occurs from ocean to ocean and extends north on the Atlantic Coast to Newfoundland, but unlike that species has become established also in the transition zone. Moist roads, damp low places, are its favorite habitats. This species may even be found in the upper austral zone where cold wet sandy roads with humus mixed afford suitable breeding places but does not ever become abundant.

Its distribution is readily accounted for on the same theory as that of *longilabris* with a greater adaptability to explain its wider range. The stronger differentiation of the Pacific variety of this and other species may be due to a separation caused by the Sierra Nevada even previous to the glacial period. The close relation between this species and *repanda* assumed by some authors seems to me erroneous. They differ in form and outline, in maculation, and remarkably in habits and distribution.

C. purpurea with its numerous varieties occurring in nearly every part of the United States and Canada is a puzzling complex, but is nevertheless soluble by the factors I have suggested. It is evidently capable of immense variation and adaptable to a variety of climates, though quick to respond to a change of climate by a change in color or marking. It has no extreme southern form nor any relative in South America but has its old world prototype. On the Atlantic Coast as variety *limbalis* it extends from Newfoundland south to West Point and Ramsey as Mr. Sleight showed us last season; as typical *purpurea* it flourishes in Connecticut, New Jersey and south

to the mountains of Georgia; as *transversa* it occurs in the same Georgia mountains and elsewhere in the south; in Maine it has developed a special form called *sprcta*. Westward it has split into many more varieties, of which most resemble the variety *transversa* more than typical *purpurea*, with the Pacific forms as usual more differentiated and more like the related old world species. Assuming an original circumpolar stock of which the Pacific branch retained the greater resemblance to the Siberian, while the Atlantic resembled the present *transversa*, all driven southward during the ice age, the Pacific branch would become isolated by the Sierra Nevada and develop the present Pacific forms, while the Atlantic form would survive in the most southerly point to which it was driven during the ice age, possibly the mountains of Georgia, spreading thence northeast and northwest and developing in the changing climates it reached the forms we now have. All the time the task of splitting the whole mass into isolated groups is being accomplished by the alternating northward and southward motion of the glacier's front. Extermination would be the result if the species, demanding as it does, only a sloping soil for its breeding place, were not adaptable to the last degree. That it is so is evident from the variety of climates in which it lives as well as from the recorded breeding places, sometimes grassy, sometimes bare, but always sloping ground. The especially remarkable feature is the great number of varieties, so great that many have never been named, the result I believe of the capacity each colony, isolated by glacial action, has possessed of adapting itself to local environment and perpetuating a modified form of the original stock.

C. repanda and *C. hirticollis* are also species which are almost reproduced in old world species; *hirticollis* extending from Maine to Florida on the Atlantic Coast and westward to California and Mexico. On Long Island and in Rhode Island the indistinctly marked form called *nigrita* by Abbott Davis occurs and in the southwest the Mexican *ponderosa*, almost indistinguishable, occurs; *repanda* also extends from Canada to Florida and spreads westward to almost every state in the union without important modifications even in color. Mr. Harris sees in these species, especially *repanda*, very ancient forms of *Cicindela* and, I may add, adaptable to various environments, which have interbred for so long a time that all the specimens reach an established neutral character.

C. tranquebarica, which on the Atlantic Coast extends from Newfoundland to Florida and westward across the continent presents a parallel case, minus the enormous development of varieties. Southward this species becomes dark, small, faintly marked, var. *vulgaris-minor*, northward brilliant, large, broadly marked, var. *horiconensis*, northwesterly it becomes *obliquata* and in the Sierra Nevada it meets the fate of other species and splits into varieties of which some are still unnamed. Its history is similar to that outlined for *purpurca* but breeding in a variety of flat sandy places, it has followed the broad plains and isolation has been less potent.

SECOND GROUP.

C. generosa is a species which does not occur in the boreal zone nor in the lower austral, which has no near relatives in the old world nor in South America, with a distribution extending from southern New Hampshire through Massachusetts, Connecticut, New York and New Jersey, across the mountains in West Virginia, Ohio, Indiana and Illinois, thence running northwest to Manitoba, where a variety is developed and southwest to northern Texas developing another variety. As already pointed out a third variety unnamed is made by our eastern specimens. I cannot see anything in this history but a species indigenous to the region it now inhabits driven southward by the glacier but returning later to its old haunts, without a capacity for adapting itself to colder regions; otherwise it would accompany *tranquebarica*, further north and south than it actually does. *C. lepida*, *C. ancocisconensis*, *C. marginipennis*, *C. rufiventris* are also parallel cases but complicated by the rigorous requirements of the species in choosing breeding places so that they have failed to spread as widely from the post-glacial colonies of survivors.

C. 6-guttata again parallels the story of *generosa* and it remained for Casey to point out the constant difference in punctuation between eastern and western specimens (compare *tridens* Csy.).

C. patruela and *C. unipunctata* present no points of difference except that their abundance in the mountains of Georgia again points to that locality as the latitude to which glacier-driven species reached in their southward movement; *patruela* has a variety *consentanea* in the New Jersey pine barrens that occurs nowhere else in abundance,

except, perhaps, the similar pine barrens of Long Island, and possibly indicates with *rufiventris* the southern limit of a separate glacial period.

C. rugifrons, including *modesta*, *unicolor*, *nigrior*, *carolinæ*, *lecontei*, *obscura*, *scutellaris* and other unnamed varieties occurs on the Atlantic Coast from Massachusetts to Key West inhabiting sandy pine woods near the coast; and, avoiding the mountains, extends through the central district to Ontario and Manitoba, though much modified in the various parts of its range. The occurrence of the black *modesta* and the green *rugifrons* side by side in the same region is puzzling. It has been suggested that larval holes of different depth would expose the pupæ during the winter to different degrees of cold with a possible resulting difference in color of imago. I know of no proof that this is true. It may also be that the black forms and green forms became separated as a result of different glacial severities and have been perpetuated since. This question must remain unsolved until the origin of varying colors in tiger beetles is better studied.

SOUTHERN FORMS.

The species that remain are mainly of the long-legged group and fall into sections according to their habitats, which may be either pine woods of the coastal plain, marshes and mudflats, river banks or the shore of ocean and gulf. They resemble the long-legged species of the West Indies, Mexico and South America and several indeed are found south of our limits as *tortuosa* in West Indies, *hamata* in Mexico, etc. They can only be regarded as emigrants from the more southern countries and it is simply a matter of suitable environment and accident that determines how far north each shall extend.

Of the pine woods species, *striga* is confined to Florida, *hirtilabris* reaches northern Florida, *gratiosa* has been found as far north as Wilmington, N. C., by Messrs. Pollard and Engelhardt, *abdominalis* is abundant in summer north to Lakehurst, N. J., and may yet be found on Long Island. The roughly sculptured form *scabrosa* is however confined to Florida. Of the seashore species *dorsalis* with its varieties *venusta*, *saulcyi*, *media* and *semipicta* has now reached Cape Cod in Massachusetts, frequenting suitable beaches all along the coast southward to Florida, around it and along the

gulf coast to Mexico, always preserving its structural characters, but much modified in size. The marsh species are *severa*, which is confined to the gulf strip, *tortuosa*, which reaches Georgia, *hamata*, which, extending south to Mexico, does not get beyond the gulf states, and *marginata* which has reached Maine as evidenced by captures made by Mr. Harris this year.

Of the river species *blanda* is confined to Alabama and Georgia and is not yet known from Florida, the form cited by Leconte living on the Roanoke River in North Carolina may be identical; the closely allied *puritana* once considered a variety of *blanda* has been found last year by Mr. Davis in Maryland. It has been reported from New York but the locality is now unknown and its principal home as the name is intended to suggest is in New England on the banks of the Connecticut River.

Punctulata may also be included with these southern emigrants on account of its related Mexican forms. Being a strong flier and attracted by lights its wide dispersal has been an easier matter than that of the other species. On the Atlantic coast it occurs from Florida to Maine and inland it is found in most of the central and southwestern states. In those cases where southern species have traveled north along the Mississippi Valley they have become modified in entering the colder zone; thus *togata* becomes *apicalis* in Kansas, *blanda* develops into *macra* and *cuprascens*, but the majority have not gone in that direction but northward along the coast, the pine woods species aided by the almost continuous pine forests of the coastal plain, the maritime species by the tides and accidents of the sea.

SUMMARY.

In conclusion I hope I have shown you that if all the facts concerning geographical distribution of tiger beetles are not accounted for by the factors suggested, by far the greater part are so accounted for and there remain none at serious variance with the theories advanced. For the southern origin of many species the evidence is overwhelming, for the northern origin of others it seems to me nearly equally strong. Outside the question of origin, the bearing of latitude, longitude, environment and accident seem approximately equal in importance, each has undoubtedly played an important part in developing existing conditions.

To attempt to define zones or regions for such a group is a hopeless task for scarcely any barrier is effective for all the species, all the time; even the seas are crossed in the abundance of geologic time; the best one can do is to indicate the avenues of distribution the insects have followed, the sea beach, the river systems, the broad valleys and plains, along which some species have travelled further, some not so far, according to the adaptability of the organism to the new environments it has encountered, and the accidents that have assisted or retarded its progress.

Such avenues of distribution have been outlined in F. M. Webster's paper in *Psyche* on "Diffusion" and, though reached by entirely different reasoning, are not very different to those here suggested.

Turning to Mr. Harris's collection for a last look at *Tetracha* you may see what has happened to that genus—the most abundant of the tribe Megacephalini, represented in South America by numerous species, more capable of sustained flight than most, attracted to light, easily spreading through the mainland of Central America to Mexico, represented there by many species, with more difficulty crossing the seas between the West Indian islands and there represented by fewer species. Finally reaching the United States reduced to two species represented by numerous individuals in our southern states but until a few years ago, unknown northward. Then thanks to electric lights perhaps, it became abundant in Cincinnati. Last year, by Mr. Davis's fortunate capture, we learned that it had reached Long Island.

It is by accident that every beetle in Mr. Harris's box has its head pointed northward, but nevertheless it indicates, as truly as the magnetic needle indicates the pole, the direction in which these species are moving.

NOTES ON THE DISTRIBUTION OF SEVERAL SPECIES OF TIGER BEETLES.

BY WM. T. DAVIS,

NEW BRIGHTON, N. Y.

On June 28, 1911, Mr. Ernest Shoemaker and the writer, with some Washington friends, went to Chesapeake Beach, Md., in search

of insects. First we walked north along the beach below a moderately high bank where there were fossil shark's teeth and various mollusks. Along this shore we found *Cicindela hirticollis* and many *Cicindela marginata*. The last mentioned is usually found on mud-flats, but in this instance the beetles were running on the beach close to the edge of the water of the bay. Later we turned south and crossing Fishing Creek, followed the beach below the very high and commanding bluffs into which the sea is ever eating its way. The soil is largely a clay, and as it falls onto the beach it mixes with the sand, and the character of the beach is thus materially changed. At high tide the water in most places comes up to the very base of the bluffs, but there are several recessions in the hills in front of which there is a narrow beach. Here we found two other species of *Cicindela* in considerable numbers, namely *repanda* and *puritana*. It was certainly a surprise to find the latter species running on the beach of Chesapeake Bay, when its habitat has been usually given as along the Connecticut River at several places in New Hampshire and Connecticut. It is also reported from "New York," but without definite locality. Mr. Leng has pointed out to me that when Dr. Leconte printed his "Catalogue of the Geodephagous Coleoptera" in the Annals of the New York Academy of Sciences in 1846, he considered the present *puritana*, as later named by Dr. Horn in 1871, a variety of *blanda*. Under var. *a* he describes it as having the elytra fusco-olivaceous with separate narrow marks, and gives as habitat Connecticut River, Roanoke River and St. Croix River in Wisconsin. The Wisconsin specimens were afterwards separated under the name of *macra* by Dr. Leconte. The Roanoke River locality has not been recently confirmed, but it must have been at least 150 miles to the south or southwest of the Chesapeake Beach colony of *puritana*.

Cicindela rugifrons has not been very often found about Washington, D. C., and Mr. Henry Ulke says of it in his "List of the Beetles of the District of Columbia," "On the hills near Benning's Station, not rare many years ago, but not found again." Mr. Frederick Knab has since found it on one occasion west of Beltsville, Md., and this past summer in company with Mr. Clarence R. Shoemaker, we found many *rugifrons*, *vulgaris* and *repanda* in an old gravel quarry at Hyattsville, Md., which is three and one half miles north of Benning's Station. All of the many specimens of *rugifrons* that we saw were spotted.

Cicindela sexguttata seems to be absent from the real pine barrens of New Jersey, but an interesting colony of the species was found on May 1, 1911, at Jamesburg. Here in an area of about a mile in diameter, covered mainly with pitch pines and with the eminently pine barren plant, *Pyridanthera barbulata*, growing along the wood roads, *sexguttata* was found in great abundance, and sixteen specimens collected. Many more were seen. *Cicindela rugifrons* is also to be found in this area, which is indicated as pine barrens on the map accompanying the last list of the insects of New Jersey.

Cicindela unipunctata was found running on a road at Ridgeway, N. J., on August 13, 1911, a cloudy day. The insect has been found to the north and south, at Lakewood and Lakehurst.

The natural prairie on Long Island which once occupied the land tracts known as the Hempstead Plain and the East Meadow has not all been plowed. There are still some areas that have fortunately remained undisturbed which support an interesting flora and many insects. The ground in places is often covered with lichens until it is gray in color; there is much *Salix tristis*, *Aster linariifolius*, *Tephrosia virginiana* and *Baptisia tinctoria*. There are pleasant park-like places with large black jack oaks and post oaks. The grasshopper *Spharagemon collare scudderii* is to be found there in considerable numbers. From these facts it might be judged that the soil is poor and barren, but it responds to cultivation and good crops are raised in the parts that have been plowed. For some time past a steam plow, that turns eight furrows at a time, has been at work, and hundreds of acres of the prairie have been disturbed for the first time. It was while walking about this interesting place on September 8, 1911, a dark cloudy day, that I found on a narrow road about a mile northwest of Central Park railroad station, a female *Tetracha virginica*. The beetle was active and running quite fast. It made no attempt to fly as I picked it up. I was astonished to find this tiger beetle unknown till the present time from New Jersey, as far north as Long Island, N. Y. It is not common in the District of Columbia; Pennsylvania is given as a locality, and Mr. Charles Dury has found it flying about electric lights in Cincinnati, Ohio. The surroundings would lead one to suppose that it was not artificially introduced, and it is certain that what remains of the one time wide stretch of natural prairie, still harbors a number of insects and plants of interest.

I would recommend it to the consideration of local naturalists, as it may be easily more fully explored by them, being near to New York and Brooklyn.

FALAGRIA MANNH. AND ITS RELATIVES.

BY A. FENYES,

PASADENA, CAL.

The genera grouped with *Falagria* Mannh. are to be distinguished from the other genera of the tribe Myrmeconiini (subfam. Aleocharinae, fam. Staphylinidae, Col.) by the following characters: head with a narrow neck; genae not margined; antennae 11-jointed; ligula bifid; paraglossæ visible; inner lobe of the maxillæ on the inner margin spinose and hairy, outer lobe at tip finely ciliate; maxillary palpi 4-, labial 3-jointed; the first two free ventral segments of the abdomen constricted at base; prosternum behind the front coxae on each side with a corneous plate; middle coxae separated (except in *Drepanopora* Brnhr.); tarsi 4-5 jointed, hind tarsi with joint 1 elongate.

SYNOPTIC TABLE OF THE FALAGRIOD GENERA.

1. Middle coxal cavities closed behind.....	2
Middle coxal cavities open behind	3
2. Mesosternum carinate	<i>Lophagria</i> Csy.
Mesosternum simple	<i>Cardiola</i> M. & Rey.
3. Right mandible bidentate	<i>Borboropora</i> Kr.
Right mandible unidentate or simple	4
4. Right mandible simple	<i>Aleodorus</i> Say.
Right mandible unidentate	5
5. Left mandible also dentate	6
Left mandible simple	7
6. Head very large	<i>Drepanopora</i> Brnhr.
Head moderately large	<i>Eccoptoglossa</i> Luze.
7. Corneous plates of the prosternum very small, the plates separated in the middle line	<i>Falagriota</i> Csy.
Corneous plates of the prosternum moderate in size or large	8
8. Scutellum unisulcate and bicarinate	<i>Falagria</i> Mannh.
Scutellum simple, as a rule	9
9. Corneous plates of the prosternum contiguous with the prosternal process	<i>Stenagria</i> Shp.

Corneous plates of the prosternum not contiguous with the prosternal process	10
10. Ligula bilobed	<i>Lissagria</i> Csy
Ligula bifid only	11
11. Right mandible strongly toothed	<i>Lorinota</i> Csy.
Right mandible feebly toothed	<i>Anaulacaspis</i> Ganglb.
Unknown to me, and not embodied in the above table are: <i>Demera</i> Fvl. and <i>Myrmecoccephalus</i> MacL.	

Remarks.—The carinate mesosternum and the closed middle coxal cavities entitle *Lophagria* Csy. to generic rank; it has the right mandible rather strongly toothed, the ligula bifid to about the middle, the prosternal plates moderately large, subquadangular and contiguous, and the scutellum simple. Type and only species: *subænca* Epp.

Cardiola M. & Rey. is at once recognizable by the entirely closed middle coxal cavities and the truncate mesosternal process. The only other Falagrioid genus with entirely closed middle coxal cavities, *Lophagria* Csy., has the mesosternal process feebly rounded at tip, and has the whole mesosternum strongly carinate in its entire length, a character not known to me to occur in any other related genus. Type and only species: *obscura* Gryh.

Borboropora Kr. The bidentate right mandible will be a sufficient character to separate this genus from all the others in the *Falagria* group. The head is very large, larger than the prothorax, transversely quadrate, the right mandible strongly bidentate in the middle of the inner margin, the left mandible with an obtuse tooth below the middle of the inner margin, the mentum subsinuate in front, the ligula bifid, the labial palpi 3-jointed, with short second and long third joint, the mesosternal process arcuato-truncate at tip, the middle coxae separated, and the middle coxal cavities open behind, the hind tarsi with joint 1 fully as long as joints 2-4 together, the scutellum punctate and without carinae. Type: *kraatzi* Fnss.

Pseudoscopæus Weise is placed by recent publications in synonymy with *Borboropora*, although Weise describes the mandibles as simple, and the tarsi as pentamerous. Type: *Reitteri* Weise.

Ancurota Csy. is a synonym of *Borboropora*, with *sulcifrons* Csy. as type.

Orthagria Csy., proposed for *quadriceps* Lec., is also a synonym of *Borboropora*.

Alcodorus Say. "Head prominent, with a distinct neck, not inserted into the thorax; antennæ inserted into the anterior internal orbit of the eye; three basal joints longest; maxillary palpi long, terminal joint acicular; thorax longitudinal, rounded on the sides, or without lateral edge; feet simple" (Say). While Say's above diagnosis is very unsatisfactory, the type of the genus, *bilobatus* Say, is sufficiently well described to be recognizable, and is accepted on our lists. The principal characters of *Alcodorus* are: the simple mandibles and the structure of the mesosternum, "its hind margin being on a rather different level to the pieces behind it, and thus appearing free, while in the middle it is not produced backwards between the coxae, but forms only a very obtuse angle" (Sharp). The scutellum is channelled longitudinally (as a rule), but the channel is sometimes imperfect, or even obsolete, apparently in specimens of the same species, the labrum is subtruncate, the mentum sinuate, the ligula bifid to about one third, the maxillary palpi with joint 2 short, joint 3 feebly securiform, the prosternum behind the front coxae with a large corneous plate on each side, the plates contiguous in the middle, the mesosternal process obtusely angulate at tip.

Chitalia Shp. has to go in synonymy, if *Alcodorus* Say is accepted, the latter being the older name. The type of *Chitalia* is: *crenata* Shp.

Drepanopora Brnhr., with type *borboroporoides* Brnhr., appears to be an aberrant genus, on account of the approximated middle coxae; other generic characters are said to be the dentate mandibles and the pointed mesosternal process.

Eccoptoglossa Luze, another monotypic genus, with *obscura* Luze as type, has both mandibles dentate, the right one acutely, the left one obtusely; the ligula is bilobed and the middle coxae are separated. The genus is unknown to me.

Beyond question is the validity of the genus *Falagriota* Csy., with *occidua* Csy. as type. The narrow, transverse corneous plates of the prosternum, separated from one another in the middle line, are sufficient to separate this genus from its allies in the *Falagria* group. Additional characters are: the robust tooth in the middle of the inner margin of the right mandible, the simple left mandible, the (at tip) bifid ligula, and the rounded mesosternal process; the scutellum is simple.

The original diagnosis of *Falagria* Mannh. (compiled from a

synoptic table) is as follows: body behind scarcely attenuated; maxillary palpi short, the last joint subulate; antennæ knee'd at base, outwardly gradually more or less thickened; head (more or less) exserted, always broader than the base of the thorax; mouth not rostrate; thorax broader at apex, mostly rounded, the angles scarcely deflexed; elytra not plicate at base; legs pubescent; the tibiæ hairy or pubescent, never really spinose; tarsi with the first joint longer than the following joints. The type is: *sulcata* Payk. In this genus the right mandible is very obtusely toothed in the middle of the inner margin, the left mandible is simple; the ligula bifid to about the middle; the labial palpi with joint 2 rather short; the prosternum behind the front coxae on each side with a large quadrate corneous plate, the two plates subcontiguous in the middle line; the mesosternal process rounded at tip; the middle coxal cavities open behind, and the hind tarsi with joint 1 fully as long as joints 2-4 together. The scutellum is longitudinally sulcate, with an acute longitudinal carina on each side of the sulcus.

Stenagria Shp. A well-characterized genus, with subsemicircular labrum, dentate right mandible, bilobed ligula, long fourth maxillary palpal joint, with large and elongate quadrangular prosternal plates, these plates being not only contiguous in the middle line, but being also in close contact with the prosternal process, with subacute mesosternal process and only slightly separated middle coxae; the hind tarsi with joint 1 considerably longer than joints 2-4 together. The scutellum is neither carinate nor sulcate. Type *gracilipes* Shp.

Lissagria Csy. can probably be maintained only as a subgenus of *Falagria* sens. lat., differing from the latter by the more deeply lobed ligula, the rather long second labial palpal joint, the smaller corneous plates of the prosternum, and the simple scutellum. It can be recognized, without much trouble, by the form of the body, the head and prothorax being rather narrow in comparison with the elytra and abdomen. Type: *laeviuscula* Lec.

Lorinota Csy. is another, rather feebly characterized genus (subgenus?), the principal characters being the rounded labrum, the strongly toothed right mandible, the deeply bifid ligula, the very long fourth maxillary palpal joint, the rounded mesosternal process and the rather long first joint of the hind tarsi. The scutellum is variable in sculpture. Type: *cingulata* Lec.

Anaulacaspis Ganglb. Proposed as a subgenus, and having rather feeble characters; the right mandible is obsoletely toothed in the middle of the inner margin, the left mandible is simple; the mentum subtruncate in front, the ligula bifid to slightly beyond the middle, the mesosternal process rounded at tip, and the hind tarsi with joint 1 about as long as 2-4 together. The scutellum is neither carinate nor sulcate. Ganglbauer assigns the following species to this subgenus: (1) *longipes* Woll. (1871), (2) *thoracica* Curt. (1833), (3) *nigra* Gravh. (1802), and (4) *lavigata* Epp. (1883). As he does not indicate the type, I venture to assume that the oldest species (*nigra* Gravh.) be entitled to that rank. It is not impossible that *A. longipes* Woll. really belongs to *Stenagria* Shp. or some other Falaciroid genus, especially on account of the projecting hind angles of the prothorax.

The feebly characterized *Falaciroma* Csy. is treated here as a synonym of *Anaulacaspis* Ganglb.; it has the right mandible feebly toothed, the left mandible simple; the ligula bifid at tip, the fourth joint of the maxillary palpi long, the mesosternal process subtruncate at tip, the middle coxae slightly separated and the middle coxal cavities open behind; the hind tarsi with joint 1 about as long as 2-4 together. The scutellum is neither carinate nor sulcate. Type: *thoracica* Curt.

Melagria Csy., having seemingly the same type species (*nigra* Gravh.) as *Anaulacaspis* Ganglb., should become a synonym of the latter.

Leptagria Csy. will probably have to be merged in *Melagria* Csy. (or in *Anaulacaspis* Ganglb., in case the above synonymy is accepted); it differs from *Melagria* in the following characters: the corneous plates of the prosternum are slightly larger, the mesosternal process subtruncate at tip, and the middle coxae a little more separated. Type: *pcrexilis* Csy.

Falaciola Reitt. is a synonym of *Melagria* Csy., having the same type species, and should fall with *Melagria* as synonym of *Anaulacaspis*.

Demera Fvl. (with *Dreema* Fvl. as synonym, the latter name being preoccupied) is principally characterized by the carinulate mesosternal process; the type is *D. forcicollis* Fvl.

Myrmecoccephalus Macl. No definite statements can be made in regard to this genus, the original description being very imperfect.

The type species, *fauveli* Solsk., is quite similar in habitus to *Lorinota* Csy., and the possibility of *Lorinota* being a synonym of *Myrmecoccephalus* may not be a remote one.

Stilicioides Broun, with *nicanus* Broun as type, is probably a synonym of *Myrmecoccephalus*.

For cabinet arrangement of the genera and species of the *Falagria*-group, occurring in America north of Mexico, the following list is suggested:

BIBLIOGRAPHY, SYNONYMY, AND DISTRIBUTION IN N. AMERICA.

Cardiola M. & Rey, Hist. Nat. Col. Fr. Brev. Al., IV, 1875, 452.

1. *obscura* Gravh. Col. Micropt. Brunsv., 1802, 74.

Pennsylvania, New York.

Borboropora Kr., Berl. Ent. Ztschr., VI, 1862, 405.

syn. *Pseudoscopaeus* Weise, Verh. nat. Ver. Bruenn., XV, 1876, 8.

syn. *Aneurota* Csy., Ann. N. Y. Ac. Sc., VII, 1893, 347.

syn. *Orthagria* Csy., Trans. Ac. Sc. St. Louis, XVI, 1906, 260.

1. *quadriceps* Lee., Proc. Ac. Nat. Sc. Philad., 1866, 371.

New York, Pennsylvania, West Virginia.

syn. *grandis* Brnhr., Deutsch. Ent. Ztschr., 1905, 21.

North America.

2. *sulcifrons* Csy., Ann. N. Y. Ac. Sc., VII, 1893, 348.

Florida.

Aleodorus Say, Trans. Amer. Philos. Soc., VI, 1836, 157.

syn. *Chitalia* Shp., Biol. Centr. Amer. Col., I, 2, 1883, 235.

1. *bilobatus* Say, Trans. Amer. Philos. Soc., VI, 1836, 156.

Missouri, Indiana, Michigan, Ohio, Illinois, Massachusetts, New Jersey, North Carolina, West Virginia.

syn. *scutellaris* Lee., Proc. Ac. Nat. Sc. Philad., 1866, 370.

New York.

syn. *granulosus* Csy., Trans. Ac. Sc. St. Louis, XVI, 1906, 235.

Mississippi, Maryland.

syn. *illustris* Csy., ibid., 235.

Mississippi.

syn. *canadensis* Csy., ibid., 236.

Quebec.

syn. *nigrescens* Csy., ibid., 236.

Iowa.

syn. *turbatus* Csy., Mem. Col., II, 1911, 176.

New Jersey.

2. *intricatus* Csy., Trans. Ac. Sc. St. Louis, XVI, 1906, 234.

New Mexico, Colorado, Arizona.

3. *partitus* Lee., Proc. Ac. Nat. Sc. Philad., 1866, 371.

Florida, Louisiana, Alabama.

syn. *floridanus* Csy., Trans. Ac. Sc. St. Louis, XVI, 1906, 237.

Florida.

syn. *novellus* Csy., Mem. Col., II, 1911, 176.

Texas.

Falagriota Csy., Trans. Ac. Sc. St. Louis, XVI, 1906, 229.

1. *occidua* Csy., Bull. Cal. Ac. Sc., I, 1885, 285.

California.

syn. *lucida* Csy., Trans. Ac. Sc. St. Louis, XVI, 1906, 257.

California.

syn. *asperula* Csy., ibid., 257.

California.

syn. *picina* Csy., ibid., 257.

California.

syn. *evanescens* Csy., ibid., 258.

California.

syn. *collaris* Csy., ibid., 258.

California.

syn. *farzinipennis* Csy., ibid., 259.

California.

Falagria Mannh., Prec. nouv. arr. Brachel., 1830, 12-14.

1. *dissecta* Er., Gen. Sp. Staph., 1840, 49.

Ontario, Manitoba, Quebec, New Jersey, West Virginia, Illinois, Missouri, Ohio, Pennsylvania, Rhode Island, New York, Wisconsin, Texas, Massachusetts, New Hampshire, Kansas, North Dakota, Iowa, Colorado, Washington, Utah, California.

syn. *iowana* Csy., Trans. Ac. Sc. St. Louis, XVI, 1906, 247.

Iowa.

syn. *ithacana* Csy., ibid., 247.

New York.

syn. *subsimilis* Csy., ibid., 248.

Colorado, New Mexico.

syn. *texana* Csy., ibid., 248.

Texas.

syn. *angulata* Csy., ibid., 249.

Utah.

syn. *sterilis* Csy., Mem. Col., II, 1911, 178.

Utah.

Lissagria Csy., Trans. Ac. Sc. St. Louis, XVI, 1906, 228.

1. *leviuscula* Lec., Proc. Ac. Nat. Sc. Philad., 1866, 371.

California.

syn. *fissilis* Csy., Trans. Ac. Sc. St. Louis, XVI, 1906, 254.

California.

syn. *impressifrons* Csy., ibid., 254.

California.

syn. *robusta* Csy., ibid., 254.

California.

syn. *minuscula* Csy., *ibid.*, 254.

California.

syn. *longicollis* Csy., *ibid.*, 255.

California.

Lorinota Csy., *Trans. Ac. Sc. St. Louis*, XVI, 1906, 226.

1. *cingulata* Lec., *Proc. Ac. Nat. Sc. Philad.*, 1866, 370.

Missouri, Wisconsin, West Virginia, Maryland, Kansas, Ohio,
North Carolina, New York, Pennsylvania, Illinois, Iowa.

syn. *tenuicornis* Csy., *Trans. Ac. Sc. St. Louis*, XVI, 1906, 243.

Ohio, Iowa.

syn. *gracilis* Csy., *ibid.*, 244.

North Carolina.

syn. *bilimbata* Csy., *ibid.*, 245.

Iowa.

syn. *sinuosa* Csy., *Mem. Col.*, II, 1911, 178.

Wisconsin.

2. *caviceps* Csy., *Trans. Ac. Sc. St. Louis*, XVI, 1906, 240.

New Mexico, Arizona.

syn. *pinalica* Csy., *ibid.*, 241.

Arizona.

3. *arizonica* Csy., *ibid.*, 241.

Arizona, Colorado, Utah, New Mexico.

syn. *fontinalis* Csy., *ibid.*, 242.

Colorado.

syn. *acomana* Csy., *ibid.*, 242.

New Mexico.

4. *parva* Csy., *ibid.*, 244.

Florida.

Anaulacaspis Ganglb., Kaef. v. Mitteleur, II, 1, 1895, 255.

syn. *Falagrioma* Csy., *Trans. Ac. Sc. St. Louis*, XVI, 1906, 226.

syn. *Melagria* Csy., *ibid.*, 227.

syn. *Leptagria* Csy., *ibid.*, 227.

syn. *Falagliola* Reitt., Fn. Germ., II, 1909, 74.

1. *longipes* Woll., *Trans. Ent. Soc. Lond.*, 1871, 284.

North America.

2. *peregrilis* Csy., *Trans. Ac. Sc. St. Louis*, XVI, 1906, 250.

Texas.

syn. *hudsonica* Csy., *ibid.*, 251.

New Jersey.

LARVÆ OF A SATURNIID MOTH USED AS FOOD BY CALIFORNIA INDIANS.¹

BY J. M. ALDRICH,

MOSCOW, IDAHO.

(WITH PLATE I.)

In July, 1911, when I spent a few days at Mono Lake, California, investigating the insects of the lake especially, I was told of a "worm" used as food by the Pai-Ute Indians of the vicinity. No opportunity for getting material came until the morning of my departure. While I was at the Mono Lake post-office awaiting the departure of my stage, the postmaster, Mr. John Mattley, an old Swiss pioneer of the basin who had taken a very intelligent interest in my work, asked me, "Have you seen the worms the Indians eat?" I replied that I had not, but very much wished to do so. Up to this time my information had led me to suppose the insects were larvæ of borers in the trunks of trees. He had two Indian women working in his hay-field, both of them at the time standing about in the road by the residence. "Come with me," he exclaimed, and approached one of the women, asking her the question, "Have you got any of those worms on hand?" The woman grinned rather sheepishly, as if expecting the subject to be a matter of ridicule, and said, "No, all gone." "But you had a lot yesterday," persisted Mr. Mattley. "All gone," was all she would reply, so Mr. Mattley took me along to the other woman. She began with the same reply, but finally admitted that there were some of the cooked ones still on hand. "Show them to us," demanded Mr. Mattley, and she led us to her camp near by, where she laid back an old cloth and disclosed a much-smoked three-quart tin bucket, nearly full of a yellowish, greasy-looking stew. Considerably excited by the prospect, I picked up a little stick and began to fish in the stew. It was half full of large caterpillars, blackened by drying, resembling dried and stewed prunes as much as anything. One of them I pulled in two and thrust a half in my mouth to see what sort of food it was. I found it tough and almost flavorless,

¹An incidental result of an investigation of the insects of western salt and alkaline lakes, carried on with the aid of an appropriation from the Elizabeth Thompson Science Fund.

with an insipidity beyond expectation on account of the absence of salt in the stew. The fat had cooked out so as to float on the fluid, and had a strong odor like linseed oil, which was in fact the only quality beyond toughness that I noticed. After I had performed the *experimentum crucis*, my hostess, if I may use the term, appeared to be relieved of the fear of ridicule, and brought out a cloth in which she had about a quart of the dried worms, uncooked. These I bought of her and brought home with me. As the stage departed about this time, I secured no farther information from her about the mode of preparing this food material. The description given me by Mr. Mattley and also by Mr. Rector of the general store near by, was to this effect: The caterpillars feed on the leaves of the yellow pine (*Pinus ponderosa*) but not on the one-leaved piñon (*Pinus monophylla*) which is much more abundant about Mono Lake. The Indians collect the caterpillars by making a smudge under the tree, for which purpose they make a trench rather close about the base of the tree; this is presumably to guard against the spread of the fire. As the thick smoke rises and envelopes the caterpillars, it causes them to let go and drop to the ground, where they are collected by the Indians, killed and dried. The preserved material is called Papaia.

A few days later, while I was at Berkeley, Cal., I had a conversation on this subject with Mr. Roy Headley, of the Forest Service in the San Francisco office. He informed me that while inspecting a national forest some distance southeast of the Mono Lake basin, he found every pine over a considerable hillside surrounded by a trench in which there had been a fire; he examined the work with interest, for fear that the forest was being subjected to an undesirable fire risk. It appeared from his statement and what I learned at Mono Lake that the collection of this caterpillar for food is an industry of considerable importance in the territory along the Nevada-California line.

Observing that the stewed specimens, of which I had fortunately saved a couple, were much fresher in appearance than the dry ones, I tried to freshen up some more material by prolonged soaking in warm water. To a certain degree it improved the condition of the specimens, but was far from making them life-like. I then tried injecting the softened specimens with gelatine, which helped a little more. The skins had too many holes in them, after manipulating them to make

them soft, to hold the gelatine very well, so I tried injecting with dental plaster of Paris, and with this I obtained some specimens that were as plump as life, if not more so, and certainly a good deal stouter. Some of these injected specimens, as well as of the shriveled dried ones, are illustrated in the accompanying half-tones.

The identity of the insect concerned remains to be considered. I was surprised to learn that no species is known to have the habits I have described. Material sent to the Bureau of Entomology elicited the following statement from Dr. Howard: "Dr. Dyar has examined the caterpillars eaten by the Indians at Mono Lake, and decided that they are Saturnians, probably of the genus *Hemileuca*, but he does not know any species feeding on pine or one so common as this must be. He suggests that perhaps it is some 'rare' species whose habits are unknown."

I append a description of a moderately distended injected larva.

Length, 70 mm. Head acorn-colored, 6.3 mm. wide, 5.7 mm. high. Width of widest body-segment (2d abdominal) 11.1 mm. Color as revived yellow mottled with paler and blackish; all the body-segments except the first and the last two crossed by a broad yellow band on its posterior part, which becomes indistinct along the sides about the vicinity of the spiracles. A central dorsal whitish stripe crosses all these bands, and its color interrupts the yellow to some extent, especially along the middle of the length. On each side of the median pale stripe is a wide, blackish stripe, interrupted by the yellow cross-bands; laterad to this is a narrow pale stripe, also interrupted. The side below this is mottled yellow and blackish, with an undulating yellow stripe below the spiracles. Ventral side yellow, prolegs, anal plate and anal prolegs acorn-colored.

The tubercles are all small, black, and so much broken off that I can only make them out by piecing together several specimens. They appear to have the following arrangement: four dorsal in a transverse series across the middle of each segment, for ten body-segments; the eleventh segment with a larger median branched tubercle (shown in profile in half-tone), and only one lateral each side; the twelfth segment with a similar median tubercle arising near the hind edge, and two pairs of lateral ones. Below the line of spiracles there appear to be two small tubercles on each segment, but they become very small and indistinct on the last three segments.



Edible Caterpillars.

EXPLANATION OF PLATE I.

All about natural size.

No. 1. Two larvæ injected with plaster of Paris.

No. 2. Four specimens partly injected with gelatin.

No. 3. Several of the dried specimens as obtained from Indian woman.

SOME OBSERVATIONS ON THE RELATIONS OF
ANTS AND LYCÆNID CATERPILLARS, AND
A DESCRIPTION OF THE RELATIONAL
ORGANS OF THE LATTER.

By E. J. NEWCOMER,

SACRAMENTO, CAL.

(WITH PLATES II and III.)

It has been known for many years that the larvæ of certain Lycaenid butterflies are attended by ants. This attention is due to the excretion by the larva, from a slit on the tenth body segment, of a liquid agreeable to the ants. There is also, on the following or eleventh body segment, a pair of evaginable organs of relation (Plate II, Figs. 1 and 2). These organs have been found in a large number of species, and Wheeler (9) states that the larvæ of some sixty-five species are reported to be attended by ants. Certain species, such as *Lycaena sonorensis*, feed within the thick leaves or in the bud-clusters of the foodplant. It would be of interest to know whether these larvæ have the organs developed to any extent.

I have made observations on the behavior of ants toward the larvæ of *Lycaena fulla* (3) and of *L. pseudargiolus*, var. *piasus*. I have found the larvæ of the latter species very generally attended in the third and fourth instars by the ants *Tapinoma sessile* and *Prenolepis imparis*, and occasionally by *Cremastogaster* and *Camponotus* (?). I kept a number of the larvæ in the laboratory, placing each individual in a separate pill box, and putting with each one or two of the ants which I had found with them. By substituting a disk of glass for the cover of the box, I was able to use a binocular microscope in watching the ants and larvæ.

The typical performance, as I have observed it, is this: An ant, on

discovering a larva, at once proceeds to stroke its posterior segments with the antennæ. The ant also feels around over the surface of the larva with its palpi. Very soon the evaginable organs of the eleventh segment are thrust out, and the ant, in its explorations, invariably touches one or both of these with its antennæ, causing them to be withdrawn. The ant immediately becomes greatly excited and darts about over the larva and its foodplant, with its mandibles extended. After several seconds it quiets down, and returns to its quest for food. The ant may be thus disturbed several times before the slit on segment ten opens, and a sort of papilla is partially thrust out, bearing a drop of a clear, somewhat viscous liquid. This the ant eagerly laps up, stroking the larva with the antennæ meanwhile. My observations show that the larva of *L. piatus* emits a drop of this liquid about every fifteen minutes.

The majority of observers who have noticed the evaginable organs at all, state that they are apparently used as signals to the ants. Seudder (6), following Edwards (1), says, "the tentacles serve, when erected, as indications to the ant that the feast is ready." I have observed nothing that would lead me to this conclusion. The organs of my larvæ were usually partially protruded when the ants were not close at hand, and occasionally one or both would be shot out to the fullest extent, but I never saw the ants pay any attention to them at these times. Thomann (7) and others think that the organs diffuse some odor which attracts and fascinates the ants. I did not discover any cells in connection with the organs, as will be seen later, that might produce such an odor. Rayward (5) has noticed that ants attending the larvæ of *Lycæna corydon* were momentarily distracted by the appearance of the evaginable organs, just as I have described from my observations of *L. piatus*. My theory is that the sharp, fang-like projections on the setæ of the organs irritate the sensitive antennæ of the ant, and cause its excitement. It seems to be an attempt on the part of the larva to rid itself of the attentions of the ants when it is not able to satisfy their demands by giving up a drop of the liquid. The organs are never protruded when the liquid is emitted, nor while the ants are imbibing it. I was not able to bring about the protrusion of these organs by touching the larva or by any sort of rough handling. If the organs were already protruded, they were at once withdrawn, when the larva was touched.

I have, on various occasions, seen an ant touch the organs before they were entirely evaginated. They were at once withdrawn, the ant showing no signs of excitement. If it is a tactful irritation which distracts the ant, this failure to become excited on the part of the ant, when it touches the partially protruded organs, would be explained by the fact that the setæ occur only on and near the tip of the diverticulum, and would not yet be exposed. While watching the ants, I noticed that occasionally one of them touched the fully extended organs with its antennæ, without appearing to be affected thereby. One ant in particular was not thus stimulated during one of my observations. A half hour later, the same ant ran about wildly whenever its antennæ came in contact with the extended organs. I cannot explain this occasional insensibility of the ants.

The action of the organs of the larva seems to be a reflex caused by the stimulus of the ant's stroking the surface of the body. When this stimulus, which is evidently transmitted by the tactile hairs, is present, one of two things occurs. If the sac in the tenth segment is in a condition to exude a drop of liquid, it is everted, and the liquid is forced to the exterior. When this condition does not obtain, the organs on the eleventh segment are thrust out. The evagination of one or both of the organs, when there is no ant present, must be caused by the relaxing of the retractor muscle due to some other cause. I had one larva which had one of these organs continually thrust out, and rough handling or contact with an ant did not cause it to be withdrawn. Apparently the retractor muscle had lost its power of contraction.

I can offer nothing new in regard to the protection afforded the larvæ by the ants, except what I have already given (3) in respect to the larvæ of *L. fulla*. Here, the commonest parasite that I found was a Tachinid. I found the eggs of this on many larvæ in the first and second instars. The ants were not attracted to the larvæ until the latter had reached the third instar. I did rear a Braconid from one larva, and it is probable that there are other parasites. I have observed no parasites in rearing *L. piasus*. The external opening of the glands in these species is present in the second instar and the evaginable organs appear in the third instar.

The slit already mentioned occurs on the caudo-dorsal part of the tenth body segment (Fig. 1). It is about 0.5 mm. in length and

narrowly oval in shape. It opens into a shallow pit (Fig. 9) bordered by tubercles giving rise to hairs. These hairs (Fig. 7, *h*) are beset with rather long spicules, except basally, and probably serve to hold the drop of liquid in place after it has been exuded. As is shown in Fig. 8, *h*, when the sac is thrust out, their position is outside. In the center of the pit is a small, transverse opening through which the liquid is voided. Directly below this opening is a sac (Figs. 6 and 7, *l*), a simple invagination of the cuticula and of the hypodermis. This fact is shown in Fig. 8. It is this sac which appears as a papilla when the liquid is voided (Fig. 2, *p*), being everted by blood-pressure and retracted by two retractor muscles (Figs. 6 and 7, *r.m.*), one attached to each side of the sac. The other ends of these muscles are attached to the body wall ventro-laterally. There are four glands supplying the liquid (Figs. 9 and 10). These are irregularly rounded, the anterior pair being the largest. Each is connected with the sac by means of a short duct. Sections (Figs. 6, 7 and 8) show how these glands open into the lumen (*l*) of the sac. The walls of the glands consist of hypodermal cells with their basement membrane (*b.m.*), and are lined with a cuticular intima (*int*) traversed by pore canals for the passage of the secretion from the cells to the lumen. The cells lining the ducts appear to be much thicker than those of the glands, and rounded within. The intima is also somewhat more thickened here. The whole organ is very much like the organs possessed by various caterpillars of the Lepidopterous families *Notodontidae* and *Liparidae*, as described by Klemensiewicz (2). In these, however, the secretion is used in defense.

The evaginable organs are found on the eleventh body segment, each being posterior to the spiracle of the same side and nearer the lateral margin (Fig. 1, *c.t.*). When these are retracted there is visible only a round or oval spot. When thrust out (Fig. 2, *c.t.*), they have the appearance of whitish cylinders, bluntly rounded at the tips, and crowned with long, slender setae (Fig. 4) arising from small tubercles. These setae are studded with fang-like projections from the base to the tip. The organs are invaginations of the cuticula and of the hypodermis. Fig. 3, drawn from longitudinal sections of the retracted organ, shows the structure. Here, a thin layer of cuticula (*cut*) forms a lining to the retracted diverticulum. In live specimens the mouth of this is closed by folds of the cuticula. At the

bottom, the cuticula is modified into the tubercles or papillæ bearing the setæ (*s*). The hypodermal layer (*hyp*) is composed of smaller cells than in other parts of the body, except about the base of the organ. Here the cells are enlarged and somewhat pyriform. The function of these cells is to produce the setæ, and each cell tapers out through the cuticular layer to one of these (Fig. 4). No cells were discovered which might secrete an odor-producing liquid. Attached to a thickening of the cuticula at the base of the organ is a retractor muscle (*r.m*) which extends to the ventral wall of the larva, where it passes through the hypodermis and is attached to the cuticula (Fig. 5). It is probable that the body-tension is sufficient to evert the organs whenever the retractor muscles are relaxed, and a contraction of these draws them in again.

The skin of the larva is rather thickly set with spreading, stellate spines, from the center of each of which arises a toothed seta. These (Fig. 3, *t.h*) are hypodermal in origin, and without doubt are tactile in function. Viehmeyer (8) states that according to Thomann's theory these hairs serve to notify the caterpillars of the return of the ants. They are scattered over the whole surface of the body, but are most numerous dorsally, and perhaps a little more thickly distributed about the glandular opening.

This paper was written in the entomological laboratory of Stanford University.

BIBLIOGRAPHY.

1. EDWARDS, W. H. (1878). On the Larvae of *Lyc. pseudargiolus* and Attendant Ants. *Can. Ent.*, X, pp. 131-136, 1 fig.
2. KLEMENSIEWICZ, DR. S. (1882). Zur Näheren Kenntniss der Hautdrüsen bei den Raupen und bei *Malachius*. *Verhandlungen d. Zool. Bot. Gesellsch. Wien*, XXXII, pp. 459-474, 2 Taf.
3. NEWCOMER, E. J. (1911). The Life Histories of Two Lycaenid Butterflies. *Can. Ent.*, XLIII, pp. 83-88, 2 figs.
4. PACKARD, A. S. (1898). A Text-Book of Entomology, pp. 368-390.
5. RAYWARD, A. L. (1906). Larvae of *Lycana corydon* and their Association with Ants. *Ent.*, XXXIX, pp. 197-198.
6. SCUDDER, S. H. (1881). Butterflies, their Structure, Changes, and Life Histories, pp. 26-27, 2 figs.
7. THOMANN, HANS (1901). Schmetterlinge und Ameisen, Beobachtungen über eine Symbiose zwischen *Lycæna argus* L. und *Formica cinerea* Mayr. *Jahresber. Nat. Gesell. Graubünden*, N. F., 44, pp. 1-40, 1 pl.—Review by Escherich. *Zool. Zentralbl.*, IX, pp. 89-91, 1902.
8. VIEHMEYER, H. (1910). On the Myrmecophily of Caterpillars of *Chrysops cneulus* F. *Philippine Journ. Sci.*, V, sec. D, No. 1, pp. 69-72.

9. WHEELER, W. M. (1910). Ants, their Structure, Development, and Behavior, pp. 357-360, 2 figs.

EXPLANATION OF PLATES II AND III.

Fig. 1. Larva of *Lycæna piasus*, dorsal view, showing position of external organs. ($\times 15.$)

Fig. 2. Posterior part of same, lateral view, showing appearance of organs when protruded.

Fig. 3. Section through retracted evaginable organ; from vertical longitudinal sections of larva. (Camera lucida drawing, $\times 320.$)

Fig. 4. A single seta of the evaginable organ, and its cell.

Fig. 5. Distal attachment of retractor muscle of evaginable organ to the body wall.

Fig. 6. Cross section of dorsal portion of larva through two of the glands; external opening not shown. (Camera lucida drawing, $\times 80.$)

Fig. 7. Central portion of same, more enlarged. ($\times 220.$)

Fig. 8. Section through opening of 10th segment, and sac, the latter everted; from vertical longitudinal sections of larva. (Camera lucida drawing, $\times 120.$)

Fig. 9. Dorsal view of glands, the skin being removed except around the opening; from dissection. (Camera lucida drawing, $\times 90.$)

Fig. 10. Ventral view of glands; from dissection. (Camera lucida drawing, $\times 90.$)

b.m., basement membrane; *cut.*, cuticula; *d.v.*, dorsal vessel; *c.t.*, evaginable organs; *f.b.*, fat body; *gl.*, gland; *h.*, hairs about opening of sac; *hyp.*, hypodermis; *int.*, intima; *l.*, lumen of sac; *l.m.*, longitudinal muscles; *o.*, opening of sac; *p.*, sac protruded; *r.m.*, retractor muscle; *s.*, setæ; *spir.*, spiracles; *t.h.*, tactile hairs.



VENATIONAL VARIATION IN CLADURA (TIPULIDÆ DIPTERA).¹

BY C. P. ALEXANDER AND M. D. LEONARD.

ITHACA, N. Y.

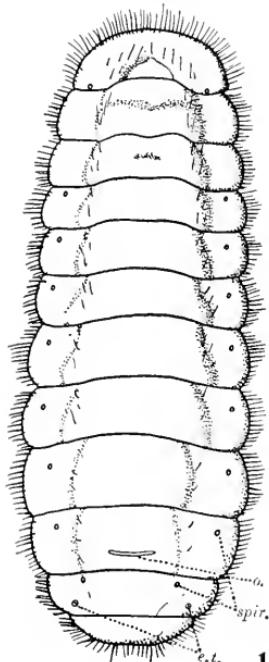
(WITH PLATE IV.)

There have been three species referred to the genus *Cladura* Osten Sacken: *C. flavoferruginea* O. S. (1859), *C. indivisa* O. S. (1861), and a species which Loew called *fuscula* (1873).² Osten Sacken asserts,³ however, that the latter is not a *Cladura* but possibly a

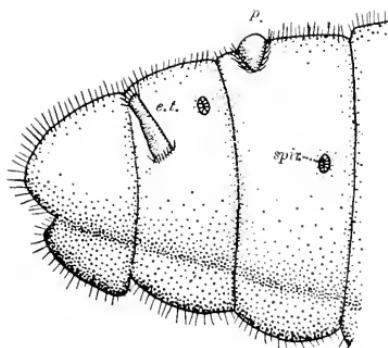
¹ Contribution from the Entomological Laboratory of Cornell University.

² Loew, H., Beschreibung Europäischer Dipteren. v. 3, pp. 64-67.

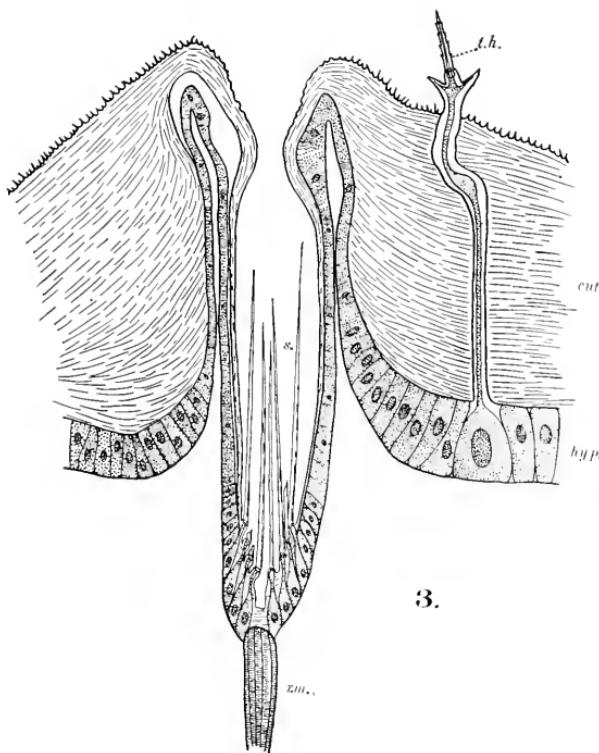
³ Osten Sacken, C. R., Studies on Tipulidæ, Berl. Ent. Zeitsch., Bd. 30, 1886, Heft 2, pp. 205, 206.



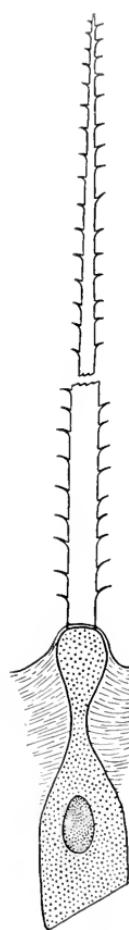
1.



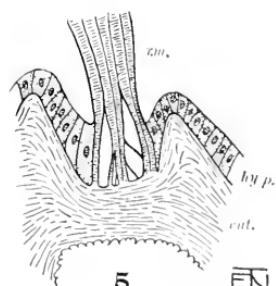
2.



3.

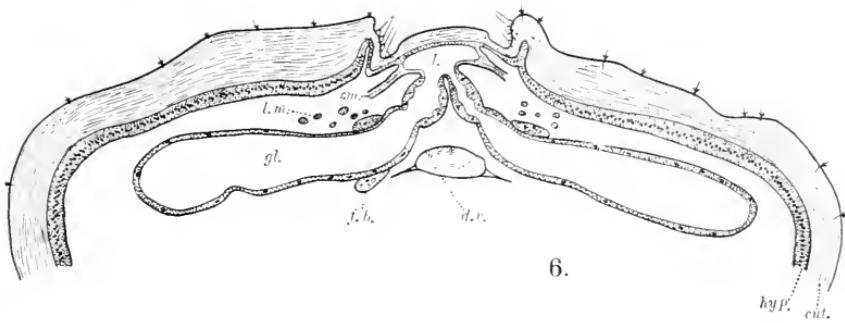


4.

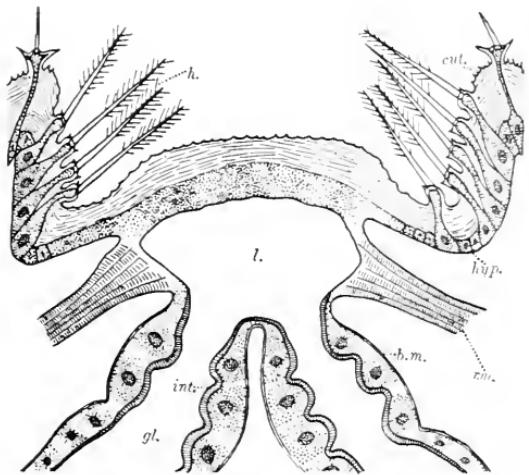


5.

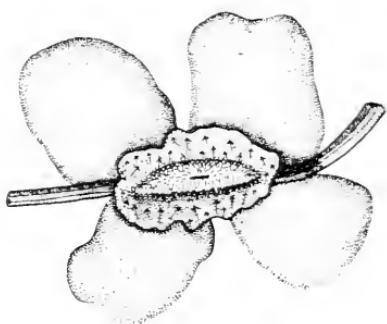
Lycænid Caterpillars.



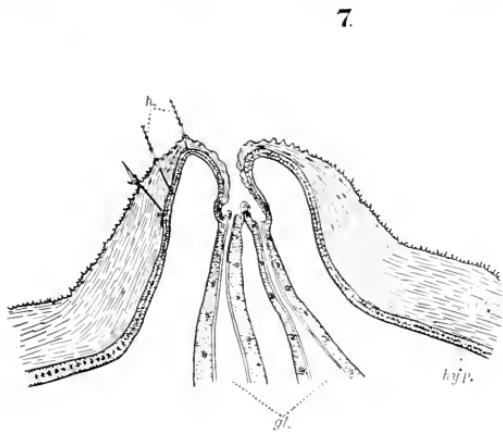
6.



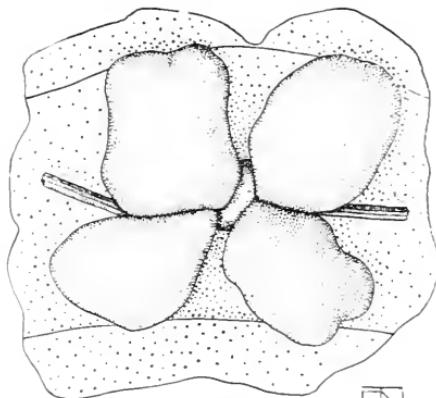
7.



9.



8.



10.

Lycænid Caterpillars.

EJ

Limnophila. Professors Mik⁴ and Thalhammer⁵ also referred this species to the genus *Cladura*, while Bergroth⁶ placed it in the genus *Ulmomorpha*. Kertesz in the Catalogus Dipterorum regards it as a synonym of *Adelphomyia senilis* Haliday, which position it still holds. Besides the recent species, Scudder⁷ has described two fossil species from the Florissant.

DISTRIBUTION OF THE SPECIES.

C. flavoferruginea Osten Sacken.

District of Columbia. Oct. and Nov. (O. S.).

New Hampshire. Hampton, Sept. 30, 1908 (Johnson, New and Little-known Tipulidæ, Proc. Bost. Soc. Nat. Hist., v. 34, p. 126).

New Jersey. Forest Hill, Sept. (Smith, Ins. N. J., 1909, p. 706).

New York. Ithaca, Tompkins Co., Oct., 1900; Sept., Oct., 1910. Erie Co. (autumn, 1909, 1910, M. C. Van Duzee).

Ohio. Wooster, Oct. 19, 1911 (J. S. Houser).

Pennsylvania. Philadelphia, Oct. 4, 1891 (Johnson, l. c., p. 126).

C. indivisa Osten Sacken.

Canada. Quebec (O. S., Cat. Dipt. N. Am., 1878, p. 31).

Massachusetts. Scudder, coll. (O. S., l. c., p. 31).

New York. Trenton Falls, Sept., 1860 (O. S.). Hamburg, Rochester, North Evans and Niagara, Sept. to Nov., 1908 to 1910 (M. C. Van Duzee). Fulton County, 600 feet altitude near Johnstown to 2,000 feet on Pinnacle Mt., 1909 and 1910.

SEASONAL RANGE.

The members of the genus are late summer and autumnal in their appearance, being, however, most numerous in September and early October. The earliest record is Aug. 20, 1909 (Woodworths Lake, Fulton Co., N. Y.); the latest, Nov. 11, 1909 (Buffalo N. Y.; Van Duzee).

⁴ Mik, J., Wien. Ent. Zeitg., 7, 30, 48, 1888.

⁵ Thalhammer, J. S., Fauna Regni Hung., Dipt., 18, 15, 1899.

⁶ Bergroth, E., Wien. Ent. Zeitg., 8, 117, 1880.

⁷ Scudder, S. H., Tertiary Tipulidæ, Proc. Am. Phil. Soc., V. 32, pp. 214-216: pl. 4, figs. 1 and 8.

VALIDITY OF THE SPECIES.

As can be seen by reference to the original descriptions and to the accounts of the species in the Monographs of the Diptera (v. 4; pp. 188, 189), the species are very closely related. The color of *C. flavoferruginica* is "ferruginous-yellow"; that of *C. indivisa*, "yellow." In both species, "pleurae spotted, abdomen banded with brown." The size of the species is the same. The main difference, however, and that on which the second species, *indivisa*, was separated, is that *flavoferruginica* has a supernumerary cross-vein in cell R_3 (second submarginal cell of Osten Sacken) while *indivisa* has none.

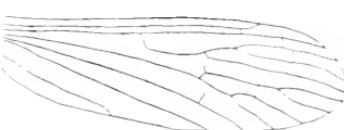
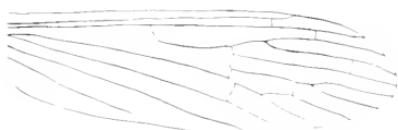
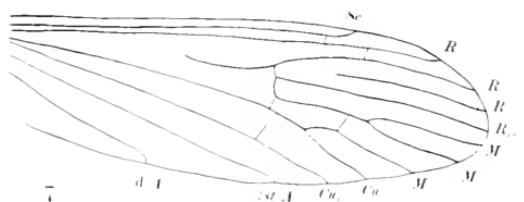
In the examination of 154 specimens, of both sexes, from the localities mentioned above, it was found that the two species are not distinct. Fifty, or about one third, were, on the basis of the supernumerary cross-vein, clearly referable to *flavoferruginica*; seventy-two, or nearly one half, to *indivisa*, while the remaining thirty-two included almost every possible intergradation between them.

It is significant that of the seven specimens of *flavoferruginica* that Osten Sacken had before him at the time of the original publication, one possessed a supernumerary cross-vein in cell R_2 in both wings. As can be seen from the following data, the species *indivisa* must fall as a synonym of the type *flavoferruginica*. Mr. M. C. Van Duzee, of Buffalo, N. Y., came, quite independently, to the same conclusion.

A STUDY OF THE WING BY FIELDS.

Subcostal field: The tendency of vein Sc_2 to migrate backwards is well-marked. In one extreme, Sc_2 equals Sc_1 ; in the other extreme, Sc_1 is fully five times the length of Sc_2 .

Radial field: Fig. 1 shows a normal *indivisa* wing possessing only the radial cross-vein. Fig. 2 shows a normal *flavoferruginica* wing, possessing, besides a radial cross-vein, the supernumerary cross-vein in cell R_3 . The radial cross-vein is probably always present. In three specimens, one a female in both wings, in the other two, males, in the left and right wings respectively, there is a supernumerary cross-vein beside the radial cross-vein (see Fig. 3). Cell R_2 : Many specimens possess a supernumerary cross-vein in this cell. This occurs both in the *flavoferruginica* form (Fig. 4) and in the *indivisa* form. In the former case this cross-vein varies greatly in its relative position to



Venation of Cladura.

the cross-veins in cells R_1 and R_2 ; when in a line with these cross-veins a strong secondary bracing is brought about distad of the cord. Fig. 10 shows a wing in which it is near the distal end of the cell. Cell R_3 : The supernumerary cross-vein of the *flavoferruginica* form occurs in all individuals referable to this form. The position of this cross-vein as compared with the radial cross-vein in cell R_1 is extremely variable. In many wings it is far distad, as in Fig. 2; in others it is exactly underneath the radial cross-vein while in a few specimens it is far proximad of it. In a few specimens (Fig. 5) a supernumerary cross-vein is found beside the normal one in cell R_3 . In one specimen, a female, the right wing is normal *flavoferruginica* as to venation while the left wing (Fig. 6) has a spur traversing only a part of the cell R_3 , thus marking an intermediate condition between the two forms. Cell R_5 : One specimen, a male, shows, in the right wing only, a supernumerary cross-vein slightly proximad of the median cross-vein (Fig. 8). Concerning the arcuation of the radial sector (*præfurca* of Osten Sacken) there is considerable variation. The normal arcuation is shown in Fig. 1 but a more gentle arcuation is common as in Fig. 8. An approach to the other extreme is seen in Fig. 4 where the tendency of the sector to be angular appears; a few specimens show this tendency very strongly, the angle being a right one and spurred. Fig. 7 shows a specimen which lacks the base of the sector in both wings.

Median field: There is little variation in the relative length of cell M_1 and its petiole. With the exception of the anal field this is the most constant in the wing.

Cubital field: The notable feature here is the variation in the position of the basal deflection of Cu_1 (great cross-vein). In some specimens it is exactly under the middle of cell first M_2 (discal cell); in others it has retreated proximad (Fig. 4) until it reaches the extreme condition shown in Fig. 9 where it is underneath the fork of M . Of two specimens from Wooster, Ohio (Houser), one has a supernumerary cross-vein proximad of the basal deflection of Cu_1 (Fig. 10); the other has this cross-vein united caudad with the basal deflection of Cu_1 , diverging cephalad to form a Y-shaped figure (Fig. 11).

The figures were all drawn to scale by means of the projection microscope in the entomological laboratory of Cornell University and

show the wide variation in the size of the wings of the various specimens.

The only other species which shows such an abundance of supernumerary cross-veins is *Tricyphona inconstans* Osten Sacken. (See Johnson, Variation in the Venation of *Amalopis inconstans* O. S.; Ent. News, v. 12, pp. 305-307.)

Acknowledgments are to be made to Mr. J. S. Houser and Mr. M. C. Van Duzee for their kind donation of material. We especially wish to thank Dr. Jas. G. Needham for his assistance and advice in the preparation of this paper.

THE OCCURRENCE OF THE MYMARID GENUS STEPHANODES ENOCK IN NORTH AMERICA.

BY A. A. GIRAULT,
BRISBANE, AUSTRALIA.

I have accidentally captured a species of the recently described British genus *Stephanodes* Enock in Illinois.

The very close relation of this genus to *Polynema* Haliday should be emphasized. It bears the same relation to that genus that *Anaphoidea* Girault bears to *Anaphes* Haliday and that *Paranagrus* Perkins bears to *Anagrus* Haliday, though, perhaps still less separable. At the best, all three are no more than subgenera. The genus *Stephanodes* was described in 1909 by Enock (1909) from *Stephanodes elegans* Enock occurring at Woking, Burnham Beeches and Somerset, England. It differs from *Polynema* according to Enock in having the scape armed beneath with a series of minute teeth, similar to those found along the under side of the posterior femora in the Chalcididae; and in habitus as expressed in its "gait" when in locomotion.¹ The habitus of Mymarids differs considerably; in the same way Trichogrammatids differ and the two families may be distinguished at a

¹ The third characteristic, the carina on the head, is common to several genera, including *Polynema*; also in *Polynema bifasciatipenne* (Girault) the scapes are slightly asperate beneath and the first funic^l joint very long, another difference between *Stephanodes* and most *Polynemas*. In some of the latter, several tuberculate teeth are present on the scape beneath.

glance when members of both are seen mingled together, running over a window pane. Genera also differ in this respect, the manner of walking being characteristic with many of them as is also their general appearance. Nevertheless, although leading to the inference that there is difference, genera separated upon habitus alone, unless very marked and backed by good structural characteristics, must be more artificial than can be said of the usual genus and, moreover, very closely allied with the group from which they are separated. But for the present it is a good thing to be able to make these separations in order to be able to recognize the species. When these latter become better known and more recognizable, then undoubtedly some of these very closely allied genera must take rank as subgenera, forming divisions of the old genus. So at present I do not hesitate to record the following new species as *Stephanodes psecas*. It is a typical *Polynema* excepting that the first funicle joint of the antenna is elongate, slightly longer than the second (usually distinctly shorter in *Polynema*, not very much longer than wide; exceptions are *Polynema reduviola* Perkins and *P. bifasciatipenne* (Girault) and the scape, when seen in outline in balsam mounts, is distinctly armed beneath with a line of minute teeth.¹ Also the marginal vein is narrower than usual but its shape varies considerably in *Polynemas*. The species is a well-marked one colorationally, being intense black with contrasting, intensely chrome-orange legs, abdominal petiole and proximal antennal joints. It differs from the type species, *Stephanodes elegans* Enoock, in its intense orange abdominal petiole, legs and scape, in having the first funicle joint longer than the second and the fourth funicle joint thicker, in having the fifth and sixth funicle joints subequal, the fifth slightly longer than the sixth; and perhaps also in the peculiar sculpture of the scape. The wings are very similar in all details but the posterior wings of *elegans* do not appear to bear discal cilia, prominent in this species but not unusual.

***Stephanodes psecas*, new species.**

Female.—Length, 2 mm.

General color intense black, the abdominal petiole, scape, pedicel, coxae, femora and tibiae intense chrome orange, contrasting, the tarsi and first funicle joint paler, yellowish, the distal or fourth tarsal joint dusky black; antennae beyond first funicle joint black but the second funicle joint less so, suffused

¹ Apparently teeth; see the descriptive details given later.

with some orange. Eyes dark. Wings hyaline. Ovipositor orange. Venation dusky. Body practically hairless.

Fore wings long and comparatively broad, their discal ciliation dense and moderately fine, about from 20 to 26 longitudinal lines of them across the widest part of the blade, but they are too close together for accurate counting of separate lines. The marginal cilia are moderate for the genus, not short nor long but somewhat over a fourth as long as the greatest width of the wing, the longest about twice the length of the distal tarsal joint for instance. The marginal vein is narrow, straight, about six times longer than wide but not much longer than is usual for *Polynema*, not long in the generic sense. The posterior wings are shorter, straight, narrow, along each edge with a double row of discal cilia and also distad with a short midlongitudinal row of about six cilia, the short line somewhat confused with the paired lines along each edge; this short row extends from the apex proximad a short distance. The marginal fringes of this wing normal, those of the posterior margin somewhat over twice longer than the blade of the wing is wide and somewhat shorter than the longest marginal cilia of the fore wing.

Legs about as described for the type species of the genus; tibial spurs single, short, straight, those of the cephalic legs longer, curved, and forked at extreme tip, forming a strigil with the row of rather sparse bristles beneath on the proximal tarsal joint at base. Posterior coxae cylindrical ovate, longer than the others which are stouter. Abdominal petiole curved, cylindrical, slightly longer than the posterior coxae. Thorax and abdomen normal, the ovipositor not at all exserted, the tip of it barely projecting beyond the end of the abdomen. Body apparently without sculpture.

Antennae normal, 9-jointed; scape subhemispherical, straight above, convex beneath and from lateral aspect armed beneath with what appears to be a row of about nine small teeth (in some aspects, notably ventral, there appear to be about three of these rows of tubercles or teeth, side by side but not visible in outline); the whole lateral aspect of one side of the scape has a distinct scaly sculpture (apparently overlapping scales, which when seen in outline beneath appear as teeth?); scape longer than the pedicel but short and moderately stout; pedicel subglobular but longer than wide, less than half the length of the first funicle joint; first three funicle joints slender, rod-like, much longer than wide, the first slightly longer than the second, about eight times longer than wide, the third joint a fourth shorter, subequal in length to the scape; funicle joints 4, 5 and 6 subequal, a fourth shorter than joint 3, broader, 6 shortest, ovate, 4 and 5 cylindrical ovate, not rod-like. Club normal, ovate, abruptly larger, somewhat longer than the united lengths of funicle joints 5 and 6. Pubescence of antennae sparse. (From 2 specimens, $\frac{2}{3}$ -inch objective, 1-inch optic, Bausch and Lomb.)

Male.—Unknown.

Habitat.—United States—Butler and Urbana, Illinois.

Types.—Accession No. 44,209, Illinois State Laboratory of Natural History, Urbana, 2 females in xylol-balsam, 1 slide.

Described from two female specimens captured on the windows of a stable on a farm at Butler, Ill., July 15, 1910 (1 ♀), and on the windows of a greenhouse, Urbana, Ill., June 8, 1910 (1 ♀). Both specimens were in the company of several species of *Polynema*.

While on this subject of Mymarid genera, I desire to call attention to some of the other genera described by Enock,¹ with *Stephanodes*. The genus *Cleruchus* Enock (*l. c.*, p. 453, Pl. XII, Figs. 6-10) certainly is very close to *Anaphes* Haliday, separated by wing characters and the longer antennal scape only.² Now in *Anaphes* the wings vary considerably in shape (as do those of some of the other genera) but a correlating variation does not occur with the venation. The same variation occurs in *Anagrus* Haliday, is limited and is one of the means by which species may be distinguished, in other words has no other than specific value. Another variation occurring in these genera and of specific value is that of the antennae (relative shape and size of the joints); in both the genera mentioned, also, the antennal scape is usually short and stout but varies so as to become twice longer than wide (*Polynema* varies in the same way, also without correlated variation). Thus *Cleruchus* is at the most no more than a subgenus.

In the same way *Erythmetus* Enock (*l. c.*, pp. 454-455, Pl. XIII, Figs. 6-10) is very close to *Anagrus*; it has broader wings than is usual with the latter genus but otherwise I do not see how it differs generically. The genus *Enasius* (*l. c.*, p. 456, Pl. XIV, Figs. 1-5) is puzzling. It has the venation of *Anagrus* and the male antenna of *Anaphes* (12-jointed as shown by the photomicrograph but in the text stated to be 13-jointed as in male *Anagrus*). *Oophilus* (*l. c.*, p. 458, Pl. XV, Figs. 1-6) is a valid genus characterized by the broad wings which are short and densely ciliated (fore wings) and the number of antennal joints borne by the female. *Stethynium* (*l. c.*, p. 452, Pl. XII, Figs. 1-5) is also a distinct genus. Its 3-jointed (so stated in the text) antennal club does not show in the photomicrograph. *Parallelaptera* (p. 454, Pl. XIII, Figs. 1-5) is valid as is also *Dicopus* (p. 455, Pl. XIII, Figs. 11-13).

¹ New Genera of British Mymaridae (Haliday). *Trans. Ent. Society of London*, December 31, 1909, pp. 449-459. Pls. XII-XV. (Plates printed in duplicate.)

² It is true the male antenna is stated to be 13-jointed, but I can count but 12 in the photomicrograph; the joints of the female are easily counted.

The discrepancies between the text and the figures are unfortunate and need explanation.

THE ANTS OF GUAM.

BY WILLIAM MORTON WHEELER,
BOSTON, MASS.

Dr. L. O. Howard has kindly sent me for identification a collection of ants from Guam, the most important of the Ladrones or Marianne Islands. This collection, made, apparently with considerable care, by Mr. David T. Fullaway, of the Hawaiian Experiment Station, is sufficiently extensive to show that the ant-fauna of the little island is made up very largely of the "tramp" species that occur on the other small volcanic Pacific islands such as those of the Society and Hawaiian groups. Only two forms, a subspecies of *Camponotus reticulatus* Roger and a variety of *Prenolepis minutula* Forel, are new to science. Most of the others are well-known tropopolitan or paleotropical forms. The various species, subspecies and varieties are enumerated in the following list:

1. *Ponera punctatissima* Roger subsp. *schaubinslandi* Emery.

A single winged female, agreeing very closely with specimens of the typical *punctatissima* sent me by Mr. Horace S. J. Donisthorpe from the hot-houses of Kew, England. This specimen is, however, not quite 3 mm. long and has the petiolar node somewhat more attenuated above than in the typical *punctatissima* and the mandibles more slender as in the subsp. *jugata* Forel. In all these respects the Guam specimen agrees with the subsp. *schaubinslandi* described by Emery (Zool. Jahrb. Abth. f. Syst., XII, 1899, p. 438) from the Island of Laysan. It thus appears that the species, originally taken in the hot-houses of Europe or out of doors only in the southern portion of that continent and in the Canary Islands, has a wide distribution in the warmer parts of the Old World.

2. *Platythyrea* sp.

A single male specimen, evidently belonging to this genus but not referable to any of the Malayan species, which have been described from worker specimens only.

3. *Odontomachus hæmatoda* L.

Seven workers and a winged female, all of rather small size (8-9 mm.), but in other respects hardly differing enough from the typical form of the species to be described as representatives of a distinct subspecies or variety.

4. *Cremastogaster biroi* Mayr.

A single worker closely resembling Indian specimens of this species in my collection.

5. *Monomorium destructor* Jerdon.

Six workers and four deälated females. This species is widely distributed through the Indomalayan and West Indian regions.

6. *Monomorium floricola* Jerdon.

Several workers, females and males. The females are wingless and subergatoid as I have shown to be the case in West Indian specimens of this tropicopolitan ant.

7. *Cardiocondyla emeryi* Forel.

A worker and male. This species is also widely distributed, occurring in the West Indies, India, Madagascar and Palestine.

8. *Solonopsis geminata* Fabr. subsp. *rufa* Jerdon.

Numerous workers and males. This is the paleotropical form of the well-known "fire ant," originally described from tropical America and in this region presenting many different subspecies and varieties. It is unquestionably this species to which Safford refers in his volume on the useful plants of Guam¹ when he says: "These little creatures, when out on foraging expeditions, travel in lines and sting every animal that crosses their path. Sometimes young chickens are killed by them. They are common in houses, and it is not unusual on turning in at night to find a line of them crossing the bed."

9. *Pheidole javana* Mayr.

Two soldiers and two workers of the typical form of the species, which seems to have a wide distribution in the Indomalayan region.

10. *Pheidole* sp.

A single small, black worker with densely punctate head and thorax, not accompanied by the soldier which alone would permit of more accurate identification.

¹The Useful Plants of the Island of Guam. Contrib., U. S. Nat. Mus., Vol. IX, 1905, p. 92.

11. *Pheidole* sp.

Four males representing two species, possibly the two preceding.

12. *Tetramorium guineense* Fabr.

Numerous workers and deälated females. A common tropicopolitan ant.

13. *Triglyphothrix obesa* Ern. André.

Two winged females, which agree very closely with the description of workers from India and are a little darker in color than three deälated females of the var. *australis* Forel in my collection.

14. *Tapinoma melanocephalum* Fabr.

Two workers. A common tropicopolitan species.

15. *Technomyrmex albipes* F. Smith.

Several workers and deälated females of this form which is widely distributed through Madagascar, southern Asia and the Pacific islands and is evidently tending to become tropicopolitan.

16. *Plagiolepis longipes* Jerdon.

Numerous workers and males and two females. This is also a widely distributed species in southern Asia and the Pacific Islands and has been taken in western Mexico.

17. *Prenolepis minutula* Forel subsp. *atomus* Forel var. *fullawayi*, new var.

A number of workers agree very closely with cotypes of the typical *minutula* of Australia in my collection and with Forel's description of the subsp. *atomus* from Ralum in the Bismarck Archipelago, except in color. This is dark brown throughout, instead of yellow, with the exception of the mandibles and tarsi, which are yellow. The head is shaped like that of *atomus*, being as broad in front as behind, and the third funicular joint is scarcely perceptibly longer than broad. The pilosity and pubescence are as well developed as in the typical *minutula*.

18. *Prenolepis bourbonica* Forel.

Four workers and a male of this species, which is known also from India, the Island of Reunion, Hawaii and the Nicobar, Cargados and Chagos Islands.

19. *Prenolepis longicornis* Fabr.

Several workers and females. A common tropicopolitan species of Old World origin, known in tropical America as the "crazy ant."

20. *Camponotus maculatus* Fabr. subsp. *chloroticus* Emery.

I refer to this subspecies several workers, males and females. Emery cites it from New Guinea, Tonga, New Britain and the Nicobar Islands, and Forel cites it from the Bismarck Archipelago, so that it is, in all probability, widely distributed among the islands of the Pacific. *C. chloroticus* is very closely related to the subsp. *pallidus* F. Smith and *subnudus* Emery.

21. *Camponotus reticulatus* Roger subsp. *fullawayi* new subsp.

Worker Major.—Length 5–5.5 mm.

Head subrectangular, excluding the mandibles a little longer than broad, a little narrower in front than behind, with nearly straight sides and feebly excised posterior border; convex above and posteriorly, obliquely flattened in front. Eyes rather large, behind the middle of the head. Frontal area distinct, triangular; frontal carinae subparallel, feebly sigmoidal, not diverging behind. Clypeus flattened, subrectangular, a little longer than broad, as broad behind as in front, feebly carinate and with a straight, indistinctly crenulate anterior border, slightly notched on the sides. Mandibles convex, with 5 subequal teeth. Antennal scapes terete, curved, enlarged towards their tips, extending about twice their diameter beyond the posterior corners of the head. Thorax above slightly convex, with very distinct promesonotal and mesoepinotal sutures, the latter somewhat deeper than the former and occupying the region of the obsolete metanotum. Epinotum with subequal base and declivity, the former in profile straight, the latter distinctly concave below. Seen from above the thorax has straight sides which converge gradually towards the narrow and laterally compressed epinotum; the pronotum is broader than long, the mesonotum as long as broad, the epinotum half again as long as broad. Petiole inclined forward, compressed anteroposteriorly, with blunt, entire and rounded border, slightly convex anterior and flat posterior surfaces. Gaster elongate elliptical, as long as the thorax. Legs rather long and robust.

Mandibles shining, finely punctate. Remainder of body subopaque, except the cheeks, legs and petiole which are more shining. Head and thorax densely punctate, the punctures on the head being larger than those on the thorax. Clypeus, cheeks, front and pronotum also with a few shallow, scattered foveole. Gaster finely, transversely striolate and with minute scattered piligerous punctures. The latter are also present on the scapes and legs.

Hairs sordid white, moderately long and sparse, partly erect or suberect and partly appressed on the head, thorax and gaster; short and appressed on the scapes and legs except at the tips of the scapes and femora where they are longer and erect. Petiolar border with at least 4 erect hairs on each side.

Black; mandibles, except their teeth, antennæ, anterior borders of cheeks and legs, including the coxae, testaceous; tips of scapes infuscated; fore coxae with a large brown spot at the base. Gastric segments each with the posterior border broadly yellow and with a golden reflection.

Worker Minor.—Length 3.5 mm.

Closely resembling the major worker in sculpture, pilosity and color and in the form of the thorax, petiole and gaster. Head much smaller, more elongate and more rounded behind the eyes, which are rather large and convex. Mandibles less convex and with more pointed tips.

Described from one minor and five major workers.

This ant is here somewhat doubtfully attached to *C. reticulatus* Roger which is represented by a number of described subspecies in the Indomalayan and Australian regions. I have, however, been unable to refer it to any of the latter, of which I have seen specimens or descriptions. It is smaller and more opaque than the subsp. *yerburyi* Forel of India and *mackayensis* Forel of Queensland, the head is differently colored and the pale margins of the gastric segments are much broader. It is more closely allied to the subsp. *bcdoti* Emery, but Emery does not mention the broad gastric bands and the epinotum of his form is described and figured as having a distinct sellate impression at the base, the petiole is thicker and the erect hairs on the petiole and epinotum are much less numerous. *C. fullawayi* also resembles the subsp. *motschulskii* of Ceylon, but this form, to judge from Emery's very brief description, is more heavily sculptured and more opaque. *C. ominosus* Forel of Ceylon and *C. weismanni* Forel of the Bismarck Archipelago seem also to be closely allied but distinct species.

CONTRIBUTION TO AN ANNOTATED LIST OF LONG ISLAND INSECTS.

BY CHRIS. E. OLSEN,

MASPETH, L. I., N. Y.

Order HEMIPTERA.

Suborder Heteroptera.

Family PENTATOMIDÆ.

Subfamily SCUTELLERINÆ.

1. *Tetyra bipunctata* Fab.

Bayshore, VII (Ol.), Pinelawn, VI [(Wh.) nymph], Promised Land (Ds. and Eng.), in the last grove of Pines on the Island (Ds.). Reported from Maryland, Washington, D. C., Texas, Mexico and L.

California (V. D.). In New Jersey Lakehurst, Da Costa and Browns Mills (N. J. R.).—Sometimes found on young shoots of old pines, but is especially fond of young trees. In cold weather often secretes itself among the dead needles that accumulate on the upperside of the horizontal branches of the pitch pine; hibernates as adult [(Ds.) N. J. R.].¹

2. Stethaulax marmoratus Say.

Rockaway Beach, V. IX, 1911 (Ds.), Kissena Park Flushing, X, 8 [(Ol.) nymph]. Reported from Georgia, N. Jersey, Maryland, N. Carolina and Texas (V. D.), Atlantic coast of the United States and California (Kld.). On cedar.

3. Eurygaster alternata Say.

Amagansett, VIII, 10 (Sf.).—Probably the most abundant and universally distributed Scutellerid found in North America; common throughout the northern States and Canada and perhaps equally abundant in the Rocky Mountain region south to New Mexico and west to California. Shows a preference for swampy spots (V. D.). Habits Carices (G. K.). In edges of marshy meadows; often common (N. J. R.).

Subfamily GRAPHOSOMINÆ.

4. Amaurochrouus cinctipes Say.

Canarsie, IX (Ol.), Rockaway Beach, IV (Eng.) and V (Ds.), Flatbush, XI (Eng.), East New York (VI, Ds.).—Reported from Montreal and N. Jersey (V. D.).

¹ The following is a key to the abbreviations of the authorities for the records cited in this paper:

- Banks. Nathan, Assistant in Div. of Ent., U. S. Dept. of Agric.
- Bno. Bueno, J. R. de la Torre, White Plains, N. Y. Hemipterist.
- Brb. Barber, H. G., Roselle Park, N. J. Hemipterist.
- Bt. Beutenmüller, William, Am. Mus. of Nat. Hist., N. Y. City.
- Bth. Bather, Wm. T., Brooklyn. General collector.
- Dow. Robert P., Brooklyn. Collector, chiefly Coleoptera.
- Ds. Davis, W. T., Staten Is. General collector.
- Eng. Engelhardt, G. P., Children's Museum, Brooklyn.
- Ol. Olsen, Chris. E., Maspeth, L. I. Hemipterist.
- Pkt. Plunkett, C. R., Flushing, L. I. Hemipterist.
- Shm. Shoemaker, Ernest, Brooklyn. Collector of Lepidoptera and Coleoptera.
- Sf. Schaeffer, Chas., Brooklyn. Coleopterist.
- Stt. Schott, F. M., Brooklyn. General collector.
- Wh. Wheat, Silas, Brooklyn. General collector.
- Zab. Zabriskie, Rev. J. L., Brooklyn. General collector.

5. Amaurochrous dubius Pal. Beauv.

Canarsie, IV (Dow). Coney Island (Stt.), Cooks Island, XII (Stt.), Rockaway Beach, V (Ols.).—Reported from Fortress Monroe, Va., Texas (V. D.), Cuba, Hayti (G. K.), Chester and Arlington, N. J. (N. J. R.).

Subfamily CYDNIN.E.

6. Cydnus obliquus Uhl.

Aqueduct, IX (Ds.).—Reported from Jamesbury, N. J., VII [Ds. (N. J. R.)], California, Utah, Texas and New Mexico (V. D.).

7. Pangaeus bilineatus Say.

Flatbush, VI, II, 1894 (Zab.).—Dr. Uhler records this from most of the eastern and southern states. Professor Osborn from Iowa and Oregon (V. D.).

8. Amnestus spinifrons Say.

Canarsie, IX (Ol.), Queens Co., VI (Eng.), Aqueduct, X (Brb.), Rockaway Beach, VI (Ol.), Flushing (Dow).—Reported from United States as far west as Colorado and Texas (V. D.).

9. Amnestus pusillus Uhl.

Maspeth, V (Ol.), Rockaway B., V (Ol.).—Common in eastern United States. Reported from Trinidad and Lower California (V. D.).

Subfamily PENTATONIN.E.

10. Brochymena arborea Say.

Queens, VIII (Ol. and Eng.), Wyandauch, IX (Stt.), Balwin, VIII (Ds.), Huntington, IX (Stt.), Pinelawn, VIII (Ds.) nymph, Calverton, IX (Ds.), Yaphank, X Ds., Flatbush, XI, 17, 1894. (Zab.), Springs, IX (Ds.).—United States and Canada. Seems to be most abundant in regions covered with forests of deciduous trees (V. D.). Mexico. Parasitized by *Trissolcus brochymenæ* Hym. (G. K.).—Members of this genus are commonly called "Tree bugs." Professor J. B. Smith mentions that *B. arborea* is often present in numbers sufficient to attract attention yet not conspicuous because of its grayish brown color harmonizing well with the bark of the trees on which it lives (N. J. R.).

11. Brochymena quadripustulata Fabr.

Port Washington, IX (Ol.), Queens, VIII (Ol.) and VII (Eng.), Wyandanch, V (Stt.), Coney Is., VII (Zab.), Parkville (Bt.). Rock-

away Beach (Bth.).—This is by far our most abundant species of *Brochymena* throughout the eastern United States and Canada. It ranges west to Arizona, Utah and California (V. D.). Feeds on *Notolophus leucostigma* (Ip.) (G. K.). Brought to maturity from nymphal stage on common cultivated bean (T. B. 3).

12. *Peribalus limbolarius* Stål.

Common all over the Island. Very abundant throughout United States and Canada. Mr. Van Duzee points out that specimens from the east are mostly large and dark colored, while the ones from the arid regions are smaller and pale (V. D.). Mexico (G. K.).—Food-plants *Solidago* (G. K.), common on shepherd's purse (N. J. R.).

13. *Trichopepla semivittata* Say.

Throughout the Island common.—Widely distributed and locally common. Northeastern United States as far west as Colorado.—Montreal (V. D.), Mexico (G. K.). Mr. Van Duzee notes: "I once found this insect in large numbers on carrot blossoms in a waste field near Buffalo, N. Y., as late as November 3 in all stages of development" (V. D.). Foodplant *Daucus carota* Kld.

14. *Chlorochroa saucia* Say.

Reported from along the cost of the Island on both north and south shore, and is apparently confined to these regions.—Reported from localities adjacent to the Atlantic seacoast (V. D.).

15. *Chlorochroa senilis* Say.

Hempstead, IX (Ol.) (Bth.), Brooklyn (Stt.), Pinelawn, IV (Eng.), Queen, III (Eng.), Rockaway B., V-VI (Ol.), VI (Ds.), VI (Bno.), Aqueduct, IX (Ds.), Amityville, VIII (Brb.), *Concy Is.*, IX, 1891 (Zab.).—Common along the coast of Long Island, Staten Island and New Jersey, southwards at least to Virginia (V. D.), [(West India ?) G. K.]. I have a specimen from Baltimore, Md., in my collection (Ol.).

16. *Chlorochroa persimilis* Horwath.

Bayshore, VII (Ol.), Promised Land, IX (Ds.), Amagansett, IX (Eng.), Bayville Beach (Banks) (N. B.). Abundant in the eastern United States north of New Jersey and in eastern Canada (V. D.). This species has been confused with *C. juniperina* Linn., which does not occur on this continent (T. B. 2).

17. *Mormidea lugens* Fab.

Throughout the Island, IV–XI, common. Common everywhere throughout the eastern United States and Canada and somewhat less abundant in the west (V. D.), Mexico and Cuba (G. K.). Food-plant: *Verbascum* (G. K.). Hibernates as adult (Ol.), Bermuda Is. (V. D. No. 2). Taken on *Ceanothus* (N. B. 2).

18. *Solubea pugnax* Fab.

Cold Spring Harbor, VII (Brb.), Long Island (Bno.), Rockaway B., V (Bs.). This is a southern species which reaches its northern limits from southern New York westward to Ohio and Iowa (V. D.). I possess a specimen from Langdon, Mo. Reported from Jamaica, Cuba, Mexico, Guatemala, Colombia and Brazil (G. K.). Foodplants: *Zea mays*, *Panicum*, *Setaria*, wheat; feeds on larvæ of *Alectia* (Cys.) (G. K.).

19. *Euschistus fissilis* Uhler.

Throughout the Island, III–IX, common. Van Duzee credits this species with being the most abundant and widely distributed of our North American Pentatomidae. It is found from Quebec to Vancouver Is. and southwards to Florida and Texas (V. D.). Found on *Zea mays* and wheat; feeds on *Alectia* (Lep.). Parasitized by *Trissolcus cuschistus*, Hym. (G. K.).

20. *Euschistus politus* Uhler.

Throughout the pine region and on Rockaway Beach in washup; locally common; V, IX.—Reported from Ohio, Massachusetts, Rhode Is., Maryland, District C., Mt. Washington, N. Jersey (V. D.). I have found it common in the pine woods of the Island by beating the scrub oak.

21. *Euschistus tristigmus* Say.

Throughout the Island; common. Common and widely distributed from northern Canada to southern Mexico (V. D.), Guatemala (G. K.). Foodplants: Potato, cotton, *Iris versicolor* (G. K.). Bred from egg to imago on fruits of *Sambucus canadensis* Linn. (Am. Elder), *Verbascum blattaria* (moth mullein). Parasitized by *Trissolcus cuschistus* Hym. Preyed on by *Dascillus tergissa* (Dipt.) and *Podisus maculiventris* (Hem.). Hibernates as adult (G. K.).

22. Euschistus varrolarius Pal. Beauv.

Common throughout the Island, IV-X. Fifty specimens were collected on Rockaway Beach washup, May 1, 1910 (Ol.). Inhabits almost the whole of United States and Canada; is especially abundant in the northern States (V. D.). Foodplants: *Asparagus*, *Carduus*, *Thermopsis*, *Zea mays*, broomcorn, oats, rye, wheat, red clover, tomatoes, raspberries, mullein, peaches, tobacco, grasses, thistle; said to feed on Lepidopterous larvae as well as sap of plants. Preys on *Pulvinaria innumerabilis* (Hem.) (G. K.). Bred from eggs to imago on *Lepidium virginicum* Linn. (wild pepper grass) and *Onagra biennis* (evening primrose) (C. O. ms.).

23. Euschistus ictericus Linn.

Rockaway Beach, IX (Ol.), Maspeth, X (Ol.), Promised Land, IX (Ds.), Flushing (Pkt.), Yaphauk, V (Brb.).—Found in the northern United States and Canada, on sedges in swampy places or along borders of streams or other bodies of water (V. D.), Elizabeth City, N. Carolina (T. B. and E.) (unusual southern record); *Carices* in wet places; *Iris versicolor* (G. K.).

24. Cœnus delius Say.

Wyandanch, VI and IX (Stt.), Rockaway B., VII (Bt.), Queens Co., VIII (Eng.), Half Way Hollow Hills, VII (Ds.), Amagansett, IX (Ds. and Eng.) Montauk, IX (Ds.), Flushing, VIII (Pkt.) and VII (Ol.), Cold Sp. Harbor., VIII (Brb.), Flatbush, VI, 1893 (Zab.).—Widely distributed and common in United States and Canada but apparently circumscribed. In north it occurs from Quebec to Vancouver Isl. Its southern range includes Florida and Texas (V. D.). Hibernates as adult under stones in fields (N. J. R.). I have kept mature insects of this species in captivity for nearly two months (from VII, 2), feeding on moth mullein, *Verbascum blattaria* (C. O. ms.).

25. Hymenarcys nervosa Say.

Rockaway B., VII (Bt.), V (Ol.), V (Ds.), Yaphauk, IX (Ds.), Cold Sp. Harbor, VII (Brb.), Flatbush (Bno.), and X, 1891 (Zab.).—Southern United States. Provancher records it from Quebec and Dr. Felt from Albany (V. D.).—Foodplant: Cotton (G. K.).

26. Neottiglossa undata Say.

Yaphank, X (Ds.).—Common in northeastern United States; its southern range probably New Jersey, Illinois, Nebraska and Colorado (V. D.).

27. Cosmopepla carnifex Fab.

Maspeth, VI-VIII (Ol.), Queens, VIII (Ol.), Rockaway B., VII (Bt.), Flatbush, IV (Eng.) and IX (Zab.), Huntington (Stt.), Cold Sp. Harbor, VIII (Brb.).—Abundant in eastern United States and Canada; its western limits seem to be Texas, Colorado and Washington (State), but it is much more at home east of the Rocky Mountains (V. D.). Foodplants: *Scrophularia nodosa*, *Ranunculus*, currants, blackberry, mints, mullein, potato, raspberry, thistle (G. K.). Bred from egg to imago on *Verbascum blattaria* (C. O.). A male has been observed to prey upon the eggs deposited by its mate, completely draining their contents (C. O. ms.).

28. Meneclis insertus Say.

Rockaway Beach, V (Ds.).—Widely distributed in United States but apparently nowhere abundant (V. D.). Taken in numbers from small hickory trees at Lewiston, N. Y. (V. D.). Predaceous on larvae of *Porthetria dispar* (Lep.) (G. K.).

29. Thyanta custator Fab.

Rockaway B., V-VIII (Ol.), Flatbush, IX (Eng.), Colverton, IX (Eng.), Yaphank, V (Ol. and Sf.).—A variable and widely distributed North American species, which becomes more abundant towards south and west. It is rare north of New York City (V. D.); common south of the red shale of New Jersey throughout the season (N. J. R.). Foodplants: *Asparagus*, *Zea mays*, wheat, grasses. Parasitized by *Trissolcus thyantae* and *Eupelmus hirtus* (Hym.) (G. K.) and *Telenomus ashmeadi* (A. W. M.).

30. Thyanta calceata Say.

Cold Sp. Harbor, VII (Brb.).—Occurs in New Jersey, N. Carolina, Connecticut, Massachusetts (H. G. B.).

31. Murgantia histrionica Hahn.

Jamaica. Reported several times on cabbage [N. Banks (N. B.)]. This common cabbage pest of the Southern States has spread northwards to the vicinity of New York City (V. D.). United States; Costa Rica; Guatemala; Mexico (G. K.). Has been taken as far north as Morris Co., N. J. (N. J. R.). Foodplants: All cultivated Cruciferae; Cucurbitaceæ, *Asparagus*; *Cleome serrulata*; grapes; *Zea mays* (Kld.). Parasitized by *Encyrtus johnsoni* and *Trissolcus murgantiae* [(Hym.) G. K.] and *Trissolcus podisa* Hym. (A. W. M.). Preyed on by *Thcognis phyllopus* (Hem.) [Lintner (G. K.)].

32. *Nezara pennsylvanica* De Geer.

Baldwin, VII (Heinreich), Calverton, IX (Ds.), Yaphank, V (Ds.) and VII (Ol.).—Seems to be rare and local from New Jersey, New York, Ohio, Iowa, Massachusetts, Illinois and Montreal (V. D.). Taken on *Ceanothus* (N. B. 2).

33. *Nezara hilaris* Say.

Throughout the Island; common (III-X).—Common throughout the northeastern United States and Canada, its southern range extending through Southern States and West India to Brazil (V. D.). Food-plants: *Citrus aurantium*, *Gossypium*, *Tilia americana*, trumpet creeper, cowpeas, tomatoes. Feeds on *Alectia* (Lep.) (G. K.). Brought to maturity from nymphal stage on common cultivated bean (T. B. No. 3). Taken on *Ceanothus* (N. B. 2).

34. *Banasa calva* Say.

Harbor Hill and Sea Cliff, III-VII [Banks (N. B.)], North Beach, IX (Brb.), Amagansett, IX (Eng.).—Tolerably abundant about Buffalo, N. Y., in Georgia, Montana, Wisconsin (V. D.). Food-plants: *Citrus aurantium* (G. K.), iron-wood trees (V. D.).

35. *Banasa dimidiata* Say.

Brooklyn (Dow), Rockaway B., VI (Ol.), Calverton, IX (Ds.), Yaphank (Sf.), Amagansett, IX (Eng.), North Beach, IX (Brb.), Quaque, VIII (Zab.). A common and widely distributed species; occurs mostly in eastern States and Canada from Quebec to Vancouver Islands (V. D.).

36. *Dendrocoris humeralis* Uhl.

Throughout the pine region of the Island; common, V-IX.—Widely distributed in the United States, beaten in numbers from scrub oak in Colorado (V. D.). Foodplants: *Carya*, *Quercus* (G. K.).

Subfamily ASOPINÆ.

37. *Striretrus anchorago* Fab.

Roslyn, 1901 [Banks (N. B.)], Rockaway B., VI (Eng.).—It has been recorded from nearly all the southern states as far north as Iowa and Massachusetts; southwardly it extends through Mexico to Panama. Van Duzee mentions four varieties. Feeds on larvae of *Papilio asterias* Lep., *Leptinotarsa decemlineata*, *Epinotia borealis*

(Glover) (Col.) and *Galeruca* (Col.) [(Uhler) G. K.]—Foodplants: *Asclepias pulchra*; *Rhus glabra* (G. K.). Preys on asparagus slugs (N. J. R.). Taken on *Ceanothus* (N. B. 2).

38. Perilloides exaptus Say.

Maspeth, VII (Ol.), Rockaway B., VI (Eng.) and VI (Ds. and Shm.).—This species seems in some of its varieties to extend across the entire continent. Van Duzee mentions four varieties. Kirkaldy gives its distribution as Canada, United States and Lower California.

39. Perilloides circumcinctus Stål.

Long Island, 1902 [Banks (N. B.)], Rockaway B., V (Ds.), eastern United States and Canada (V. D.). Feeds on larvae of *Lep-tinotarsa decemlineata* (Col.) (G. K.) and of various other beetles (N. J. R.); also on both larvae and mature insect of *Trirhabda tomentosa* Col. (Ol.).

40. Mineus stigipes H. S.

Maspeth, VII (Ol.), Rockaway B., VI (Eng.), Flatbush, VII (Kate Z. Wells—Zab.), Huntington, VI (Stt.), Flushing, VII (Pkt.) and VIII (Ol.), Cold Sp. Harbor, VIII (Brb.). Reported from New York, New Jersey, Maryland, S. Carolina, Georgia, Texas, New Mexico, Ohio and Washington, D. C.; also included in Baker's list of Hemiptera of Colorado. Taken on *Ceanothus* (N. B. 2).

41. Apateticus cynicus Say.

Rockaway B., VII (Ol.) and (Stt.), VIII (Eng.), IX (Bno.) (Bth.) and (Dow), Yaphank, VII (Ds.), Amagansett (Sf.).—Common throughout eastern United States and Canada; Texas (V. D.).—Foodplant: Apple, oak, etc.; feeds on the sap of trees (Glover), on the larvae of *Alectia* (Lep.) and *Leptinotarsa decemlineata* (Col.) and of *Nematus ventricosus* (G. K.). Predatory on slugs of all kinds (N. J. R.).

42. Apateticus bracteatus Fitch.

Rockaway Beach, VII–VIII (Ol.), IX (Bno.), Fire Island, IX on Cresches (Ds.), Flatbush, IX, 1892 (Zab.).—New York, Idaho, Montreal and Vancouver; a distinctly northern species (V. D.).

43. Podisus maculiventris Say.

Common all over the Island, V–X; one example taken at Glendale Swamps as early as January 6 in the act of preying on some insect

(Dow). It is common over a great part of the United States and Canada, but becomes less abundant west of the eastern slopes of the Rocky Mountains (V. D.). Principal food of nymph vegetarian, apple, etc.: larvae of *Salandria barda* (Hym.), of *Pristiphora glossulariae* (Hym.), of *Alabama argillacia* and *Heliothis obsoleta* (Lep.), of *Gallerucella luteola*, *Haltica chalybea* and *Leptinotarsa decemlineata* (Col.), nymphs of *Euschistus tristigmus* (Hem.) (G. K.); *Adalia bipunctata*, *Epitragus arundinis* (Col.); larvae of *Pieris rapae*, of *Alypia octomaculata*, of various Noctuids and geometers (Lep.); in captivity highly cannibalistic.—Foodplant: *Onagra biennis* (Ol.). Parasitized by *Trissolcus podisi* (Hym.) (G. K.) and *Trissolcus thyanthæ* (Hym.) (N. J. R.).

44. Podisus serieventris Uhl.

Sea Cliff, V-VIII (Banks), Bayshore, IX (Ol.), Amagansett, IX (Eng.), Rockaway B., IX (Bno.).—Vancouver Is., Montana, New Hampshire, Massachusetts (V. D.).—Feeds on larvae of *Atlacus promethea*, *Clisiocampa americana* and *dissitia*, *Hyphantria cunea* Lep., dead imagoes of *Limenites ursula* and *Pyrophila pyramidoides* (Lep.), also *Podisus cynicus* and *Meneclles insertus* (Hem.), and all stages of *Porthetria dispar* Lep. (Kirkland). Foodplant: *Quercus rubra* (G. K.).

45. Podisus modestus.

Brooklyn (Dow), Rockaway B., VI (Ol.), Yaphank, VII (Ds.), Amagansett, IX (Eng. and Ds.), Flatbush, VII (Stt.), Long Beach, VII (Stt.).—Common throughout the northeastern United States and Canada (V. D.), Mexico and Hispaniola (Kld.). Feeds on larvae of *Hemileuca maia* (Lep.) and *Nematus erichsonii* (Hym.) and of *Haltica chalybea* (Col.). Foodplant: *Clematis ligusticifolia*, *Solidago* (G. K.). Parasitized by *Telenomus podisi* (Hym.) (G. K.).

46. Podisus placidus Uhl.

Throughout the pine region of the Island and Rockaway Beach in washup; common, V-IX.—Recorded from Canada, Massachusetts, New York, Michigan, Colorado and Iowa (V. D.). Foodplant probably scrub oak.

Subfamily ACANTHOSOMINÆ.

47. Elasmucha lateralis Say.

Rockaway Beach, VI (Ol.), V (Ds.), Yaphank, VII (Ds.).—

Widely distributed in northern United States and Canada. Distant reports it from Mexico (V. D.).

48. Elasmostethus cruciatus Say.

Rockaway Beach, VI (Bno.)—New York, North Carolina, Montreal, Utah and Vancouver Islands (V. D.).

BIBLIOGRAPHY.

- N. B. 1. NATHAN BANKS. Addition to the List of New York Pentatomidae. *Journ. of N. Y. Ent. Soc.*, 1903, 227.
- N. B. 2. —— List of Insects taken on Ceanothus. *Ent. News*, 1912, p. 105.
- H. G. B. H. G. BARBER. The Resurrection of *Thyanta calceata* Say from Synonymy. *Journ. of N. Y. Ent. Soc.*, Vol. XIX, June, 1911.
- T. B. 1. J. R. DE LA TORRE BUENO. A Preliminary List of Pentatomidae within 50 Miles of New York. Westchester Heteroptera I and II. *Journ. N. Y. Ent. Soc.*
- T. B. 2. —— European Heteroptera supposed to occur in America. *Can. Ent.*, Nov., 1909, pp. 401-402.
- T. B. 3. —— *Can. Ent.*, 1909, p. 134.
- T. B. and E. J. R. DE LA TORRE BUENO and G. P. ENGELHARDT. Some Heteroptera from N. Carolina. *Can. Ent.*, 1910, pp. 147-151.
- V. D. E. P. VAN DUZU. Annotated List of Pentatomidae North of Mexico. *Trans. of Am. Ent. Soc.*, Vol. XXX.
- V. D. 2. —— Notes on some Hemiptera taken in the Bermudas, by W. J. PALMER. *Can. Ent.*, 1909, p. 134.
- G. K. G. W. KIRKALDY. Catalogue of Hemiptera (Heteroptera), Vol. I, *Cimicidae*, 1909.
- A. W. M. A. W. MORRILL. Description of a New Species of *Telenomus* (Hym.). *Amer. Nat.*, Vol. XL, 1, No. 487, pp. 417-430.
- C. O. CHRIS E. OLSEN. Notes on Breeding Hemiptera. *Journ. N. Y. Ent. Soc.*, Vol. XVIII, 1910, pp. 39-42.
- N. J. R. J. B. SMITH. List of Insects of New Jersey. *Annual Report of the N. J. State Museum*, 1909.



OBSERVATIONS ON THE LIFE HISTORY OF
ENCHENOPA BINOTATA SAY.

BY IGNAZ MATAUSCH,
ROSELLE, N. J.

(WITH PLATES V AND VI.)

During the past few years I have been engaged in a systematic study of the Membracidae and have prepared a number of enlarged

water-color drawings of both adult and nymphal forms. It is now my intention to make a careful study of the life histories of these insects, as opportunity offers, more especially of the local forms.¹ As a contribution towards this subject I present in this paper an account of the eggs, larvae and nymphal forms of *Enchenopa* Am. & Serv. *binotata* Say.

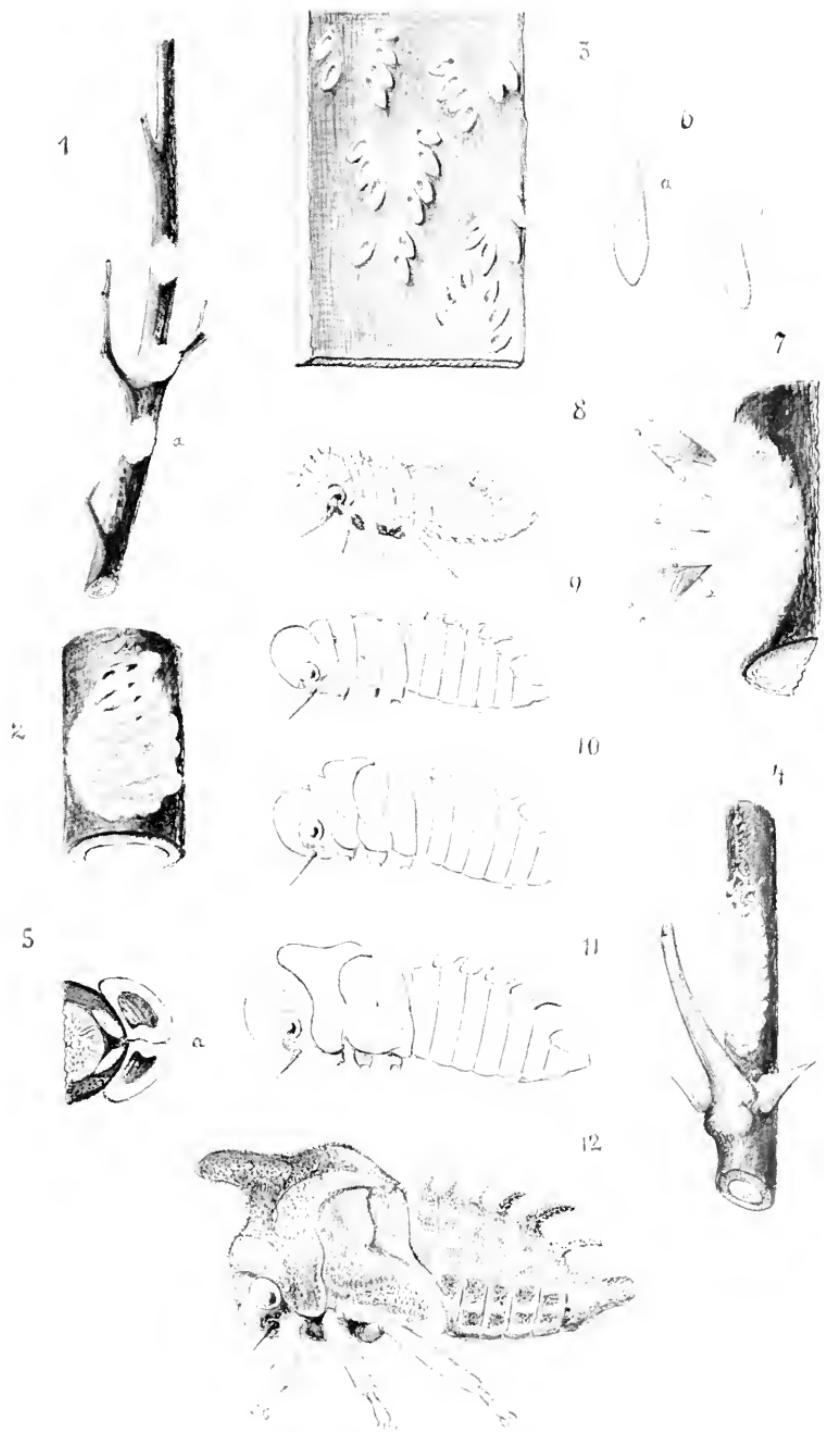
The nymphs of this form were the first known to me; and after repeated and painstaking search I have succeeded in finding their eggs and in rearing them. When I began, I had not seen the work of Dr. I. A. Lintner in his bibliography from 1882 in Ins. N. Y., 1st Rep't, pp. 281-288. Dr. E. B. Felt recently called my attention to it. In entomological works of later date I have found either no mention of the eggs of this species, or the statement that the eggs are laid in frothy masses on the twigs. This seemed strange to me, since I found that the insects have a rather strong ovipositor. Two years ago I examined a number of twigs richly covered with frothy masses, kindly sent me by Dr. B. E. Dahlgren, of the Field Museum, of Chicago, and by Mr. William Reiff, of Forest Hills, Mass., but a careful examination of this material failed to reveal any eggs.

Thinking that perhaps I had destroyed the eggs with the frothy substance, I tried to find fresh material myself. While searching in Central Park, New York, late in the autumn of 1909, I fortunately found two females at work on sheepberry (*Viburnum*); one had nearly finished forming the froth, the other had just begun. The latter was within my reach, so I broke off the twig carefully and took it home, together with the insect, and put it in a glass for closer observation. This change did not interfere with her activities, which indicates how absorbed these insects are in their work. The female produced the frothy substance in the form of a kind of foam, but eggs were not found in it. About three quarters of an hour is consumed in completing this work, sometimes perhaps longer, depending on the size and numbers of the layers. Fig. 1, Pl. —, shows the twig which I collected, somewhat enlarged, Fig. 1a, the mass that was partly produced in captivity, and Fig. 2, the same mass much magnified. The insect under observation died on the following day.

During 1910, from May 28 to July 4, Dr. Dahlgren sent me four

¹ I wish to express my thanks to Professor Wm. M. Wheeler and Dr. E. B. Southwick for kindly giving me much valuable advice in these studies.

different lots of perfectly fresh twigs of *Ptelea trifoliata*. He says in his notes: "The branch with the *Enchenopa* which I sent you is of the hop-tree (*Ptelea trifoliata*). The insects have, during the past two summers, been quite numerous in Jackson Park, Chicago, but I have not found them on any other shrub or tree." In the first lot received, I could find no eggs for some reason, the frothy masses appearing to have deteriorated. They were dirty, dry and brittle, but under the microscope showed numerous nymphs, which, as I stated later, were in the first stage. They were so small (between 1-1.3 mm.) that I was unable to see them with the unaided eye. I was not sure whether they really came from the supposed egg-masses in the above-mentioned condition. I then split one of the twigs, and taking off the bark, found on its inner side the empty egg-shells, with a few entire eggs. This proved that what I had erroneously taken for egg-masses were merely masses of a substance heaped over slits on the bark, somewhat in form of egg clusters, for a protective purpose. The eggs are really laid in two rather parallel slits which are made in the bark, side by side, in more or less obliquely arranged rows, as shown in Fig. 3, which represents the inner side of the bark. The frothy masses, if protected from wind and weather, however, seem to persist for some time, as I have observed in specimens of twigs kept in my collection for the past four years. I found considerable variations in the insects, taken from different plants, not only in the color of the nymphs, but also in the form of the egg-mass, number of eggs, and in the forms of the protecting masses. On *Viburnum* and *Robinia* the egg-groups are more numerous and always laid in one direction, as they rest mostly with the head directed upward and outward, in crowded conditions, as shown in the bark of *Ptelea* in Fig. 3, where one of the groups had been placed in the opposite position. But this does not seem to be the case where the insects occur in smaller numbers, since it has not been found on both the plants observed by myself. On *Viburnum* I found that they often prefer to begin on the forkings of the twigs; on *Robinia* above the bases of the leaves or thorns as shown in Fig. 4. In 10 specimens of covered egg-groups on *Viburnum*, I found the number of eggs in a group ranging from 9 to 17; on *Robinia*, by inspecting 4 specimens, from 11 to 16, placed rather irregularly in the slits, as one of them contained 10, the other of the same group only 4 eggs. On the thicker twigs of *Viburnum* the



Enchenopa binotata.

rows often run together in a horseshoe-like formation and one or the other egg is placed to one side of the row, especially just below it, sometimes filling the space between them. On *Robinia* the rows are straighter, in *Cicada* fashion. In covering the eggs with the fatty mass the insect always starts below the slits, for which purpose she lifts her abdomen and by moving the ovipositor down and up transfers the substance to the tip, from which it is directed to the desired place by moving the whole body. In the beginning the layers are very short but soon they become longer, as the height increases, and assume more or less the shape of a string, to become about half way beyond of the approximate height of 4 mm., then shorter again, so as to form more or less of a rounded shape on *Viburnum*; and more oval on *Robinia*; on the latter plant they become only half as broad as on the former. Mostly those layers appear somewhat slanting down from both sides to the center, where the insect usually stops and connects the half built layer with the bark of the twig. From this point on the outer end of the layer becomes connected with the bark by means of a thinner string. And they build these masses, sometimes half as high, sometimes fully as high from the twig, as they are broad, leaving on each side a hollow space as seen in Fig. 5, which shows the inside structure about the middle of its length strongly magnified. At that place in the center the more or less frame-shaped layers meet and are often connected with a short separate layer (Fig. 5a). On *Viburnum* the work appears sometimes coarser than on *Robinia*, where the insect needs some 15 layers. On *Viburnum* I sometimes counted only 9, in which case I found the layers mostly very loose in the upper portions, with holes through which the bark of the twig could be seen. They generally end with the small layers irregular.

The beginning of oviposition I observed on *Viburnum* in Roselle, N. J., on August 6, where the first three specimens of egg-coverings were found, of which one only was half finished. I tried to bring the insect home in a glass, but it had been thrown off by a leaf, and in captivity did not finish. It died after five days. I noticed that if the insect was violently removed, it would not return, as I found one half-finished covering on the bush, without any female nearby. About a week later a new mass was built on to it. The first mentioned half-finished covering gave me an opportunity to study its finer structure, as above described. On *Robinia* in Nahant, Mass., this

season, I found the first insects in the act of egg-covering on August 15. They always worked on the under side of the branch, and on the south side of the bush, as they do on *Viburnum*.

The oviposition of *Enchenopa binotata* lasts until October, when the frosts kill them. During that month I found the insects less lively and in one case, on October 8, I found one insect on the same spot and in the same position as the preceding week. Thinking it was dead, I took it down, but while holding it in my hand for a little while, it revived and leaped away before I got the bottle ready for collecting it.

How many of the covered egg-groups are produced by one female I have not been able to make out, but there are a number. Of the insects I collected at work on August 6, I found one containing 6, the other 10. In the insect with the half-finished covering there were 5 more eggs. On September 3, one insect collected purposely for inspection still had 19, another on October 1, 7 eggs, and one collected on October 8, which died on the 14th, had still 24 eggs, of which 4 were found in the thorax and 20 in the abdomen.

The autumn eggs differ from those eggs found in spring (Fig. 6a), being thinner, a little curved, as shown in Fig. 6b. According to the statement of Dr. Lintner (p. 286), concerning the eggs of *Enchenopa binotata* on *Celastrus*, inspected by Dr. Hagen, they must vary considerably in size and color, for his measurements are different from mine on *Ptelea*, *Viburnum* and *Robinia*, where I found them about 1-1.3 mm. in length, and of a more or less milky, glassy appearance. Mr. Sidney I. Kornhauser recently favored me with a letter, in regard to his observations on that species, in which he says: "The frothy mass is secreted from a pair of big sacs at the end of the oviduct. These sacs have glands attached, and contain a very sticky substance. Both cuts are then covered by this white froth. The eggs are first soft and often much out of shape, but later they become more rounded and force the crack in the stem open." Oviposition lasted from August 6, during the month of September, until October. Most work had been done in the first part of September; from that time on I could not find the coverings increasing much in number. Of course, the observed bushes had been frequented only by a small number of insects and so I found colonies of the egg coverings very small. The best covered twig showed on October 15 only 11 specimens; the

number of insects I found on October 15 was greatly reduced from those of October 8, on which 6 specimens had been found; on the 15th there were only 3. The insects, although it was the middle of the day, seemed to be very weak since when I touched one, it hardly moved; another I saw somewhat higher on the limb, just beginning to move, at the same time a slight breeze sprang up, the insect fell to the ground and being much of the soil color, I was unable to find it.

While hunting for eggs of these species in the spring on the above-mentioned bushes on *Viburnum* I found markings on the twigs of egg-covering, which seemed to be of the previous season. The slits were partly open, somewhat exposing the eggs. On May 7, I took one of the twigs home, hoping to be able to observe some of the developing nymphs. For that purpose I kept the twig in water, but as it began to wither, I started out on May 14 at 6 o'clock in the morning in order to get another fresh twig. I found on several of the egg-areas some yellow objects moving, but owing to their small size was unable to make out their nature. But with the magnifying glass at home I saw that they were the larvae making their escape from the eggs and at one spot as shown strongly magnified in Fig. 7, they came out six at a time. Two had partly emerged, the rest were just commencing. By watching the spot carefully I found the last one ready to emerge at 9 o'clock. Then looking over the twig first collected, I found a number of developed nymphs.

The larvae are of a light yellow, with crimson eyes, and somewhat more orange-red markings on the abdomen, covering laterally, three segments from its base. In the larvae this color runs together, nearly forming a ring, but in the nymph stages, where the abdomen extends, and also in the adult stage, it forms two lateral red markings. The larvae on first emerging are smooth, but when they come about half way out, they commence to build up the first stage of the nymph. The head first assumes its form, and the hairs on it, that had been smooth, stiffen out, as do also the body-rings one after another. The legs become free, and then the abdomen takes on its shape, the latter having in that stage the prominences very short with long hairs. All the hairs are rather long in this stage, curved and directed backwards. Then the insect gets a hold on the twig and, freeing itself entirely from the egg, after a short rest, walks up to the leaves, probably to feed near the base on the petiole. This seems to be their

favorite place, as it offers more protection at first, being of the same yellow-red as the nymphs. The nymphs rest in one place most of the time; before shedding they become very restless and look for a suitable place. In the first stage, especially, I noticed that they preferred the under side of the leaves. They seem not to like to be exposed to light during ecdysis. I had been watching one ready to shed, and it moved out of the sunlight, at the last minute, where I had put it to see the breaking open of the thoracic integument. A little later the insect was already partly out. During the process the nymph stretches the whole body, and owing to this extension, the skin breaks open on the upper part of the head and thorax; the insect then pulls out the head first, then the thorax with the legs, and finally the abdomen, usually resting for a little while on the empty shed skin, before leaving it. This process takes place in the morning hours. I seldom observed it later. The insect puts its piercing mouthparts into the plant at once, as I usually found the empty, shed skin fastened beside the legs. It is characterized by changes in all the larval colors. In the later stages, the fore parts, the abdominal prominences and anal region are whitish at first, the abdomen more or less greenish the lateral red markings somewhat restricted. In the adult stage, before changing into the more or less dark brown color, these lateral markings occupy only the second of three segments fully, on the first and third only half the width of the segments. The whitish yellow on the fore parts becomes after the second stage, as I noticed in the nymph before shedding, more or less of a pinkish red; likewise the abdominal prominences and anal region, but these always soon change to the darker color after shedding. In the first stage, after about two hours they become a very glassy gray. Then, by the night of the same day, they become brownish-gray above. Ventrally the abdomen remains green, the mouthparts, pectus and femora of a dark, almost black, shining brown; except in the last nymph stage, when it become a somewhat lighter red-brown.

In the brownish gray stage the material from Chicago was received. What I missed then, I found during the second day in the insects under observation this season; they appeared dorsally with a whitish covering of an apparently porous nature. I found this also (although slightly) on the brown-gray colored nymphs from Central Park, New York. As I collected mostly all the material in the later

stages, I found the covering always very slight, only feebly developed on the head and margins of the body. On the nymphs collected from oak and walnut I have not seen any such covering. This covering is only on the dorsal portions, and very little of it on the legs (the apex of the femora and upper parts of the tibiae). The porous covering shows best in the empty shed skins of the first two stages; it is then of a very brilliant white. It diminishes in every following stage and there is none in the adult. I found the covering in the adult on the head and prothorax only on one southern species from Brazil (*Sphongosphorus*). This was of a yellow color.

The color of the nymphs I had previously seen was always more or less brown-gray, but they vary in color on the different plants, and even on one and the same plant. The front parts become more or less brown from pink, and sometimes on and above the head a little greenish; the abdomen laterally more or less red-brown. This color starts from the red markings, and gradually occupies the ventrolateral parts and becomes somewhat darker and fades into greenish on the dorsal region. Then in the later stages the insects acquire five lateral rows of grayish-white markings. The abdominal prominences and anal region are more reddish-brown, the fourth and fifth pair of the former being in the last two nymph stages very dark. The hairs which are long in the first stage, become short in the following stages, but greatly increase in number, especially on the abdominal prominences. The lateral white markings were found on the dark-colored nymphs from Central Park, but more yellowish and only slightly indicated. On the material collected at Newark, N. J., on oak and walnut last year, there was none of the lateral white markings; and the coloration was quite different from all the nymphs I had seen before, so that at first I was inclined to believe I had taken another species. The specimens were of a beautiful green color, on the fore parts (prothorax and wing-pads) red, shading very slightly into brown; the basal portions of the legs, the pectus and mouthparts were brown; the tibiae and abdominal prominences yellowish, suffused with rose-red; the anal region and the venter darker passing into brown. The first nymphs of this description were found July 26, on oak. July 1, the same form, only somewhat larger, was taken on walnut. July 6, I could find no more specimens on oak but in addition to adult insects (three males and one female) there were two nymphs. The

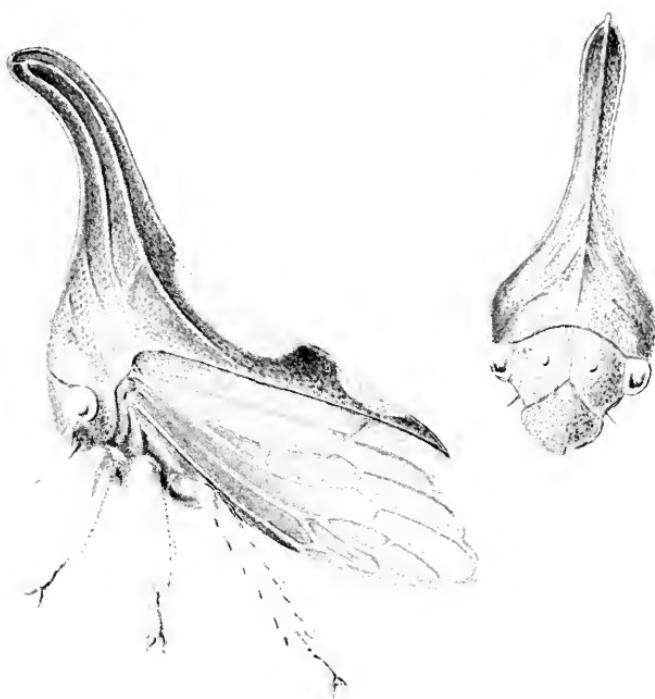
smaller nymphs found on oak, produced in confinement, on July 5, only males, while the large ones from walnut produced females exclusively on July 4. Of the two nymphs collected July 6, one produced a female on the following day, the other was killed. Notwithstanding the light color of the nymphs all the imagines were of a beautiful dark color. The prothoracic prominence is in the females always longer and in some of the males very short, but on walnut I noticed that the males had the prominence similar to that of the female, although the insect was smaller.

This season while looking for nymphs I found on oak only one *Enchenopa binotata* nymph on June 23, another on walnut on June 30, at Roselle, N. J. The former was exactly of the color of a *Campylenchia curvata* nymph, green and brown, and only differed in the form of the abdominal prominences. The insect from walnut was more similar to those collected last year at Newark, only less brown and more pink-red on the fore parts; the abdomen was more downy yellowish-green with the prominences, anal region and tibiae of a salmon color. The abdominal prominences are very small in the first stage, become longer, slightly curved and directed backward in the following and persist also in the form of very small rudiments in the adult stage. The wing-pads start in the third stage. In the nymphs of *Enchenopa binotata* there are five stages, before they grow into the adult form. The nymph forms are shown in Figs. 8-12, the adult in Fig. 13 greatly enlarged. The insect measures about 5.2 mm. in the male, 7 mm. in the female. It takes 32 days for the full development from the egg to the adult. I had the nymphs as follows:

	Measurements of the Empty Shed Skins. Mm.
In the first stage from May 14 to 21.....	$1\frac{1}{2}$
In the second stage from May 20 to 25	2
In the third stage from May 26 to 31	$2\frac{1}{2}$
In the fourth stage from June 1 to 14	3
In the fifth stage from June 8 to 15	5

The first adult to develop was a male.

These insects, despite all their protective masses, suffer severely from parasites; Mr. Kornhauser says: "I have found a majority of the *Enchenopa binotata* infested with a large internal parasite." I



Enchenopa binotata.

found a great percentage with imperfect egg coverings, having one or sometimes two holes, doubtless caused (as it seems to me) by another insect. In three cases I found the covering entirely removed, leaving a thin outline, and the eggs were entirely absent. I have placed enlarged wax models of my own construction demonstrating the metamorphosis described above in the American Museum of Natural History.

MISCELLANEOUS NOTES.

A Membracid and Mimicry.—At Tumatumari, British Guiana, I saw on cashew leaves what appeared to be an aggregation of small black ants. I suspected that they were attending aphids and as I got closer saw what I took to be the aphids, so I held a vial underneath a cluster intending to shake them into it, but "aphids" and "ants" hopped off together. After that I was more careful and found them to be *Cyphonia clavigera*. The wings were the aphid; the curious pronotum was the ant.

Since this experience I have seen Poulton's remarks in Buckton's Monograph of the Membracidae which are as follows:

"The remarkable combination of filaments and dilated spheres developed by the pronotum in certain species of the genus *Cyphonia* may be compared with the still more extraordinary and complex structures in *Bocydium*. In the absence of observations on the spot, the most probable interpretation is to suppose a cryptic resemblance to some vegetable structure, such as a spined fruit or seed specially adapted for anchorage in the fur of animals; or some complex development of thorn or spine. When we consider how far the Neotropical Region surpasses the rest of the world in the amount and variety of mimetic resemblance in insects we see the outcome of a selective environment which may well have developed cryptic forms more strange and complex than any that are known elsewhere. But the possibility of mimetic likeness in *Cyphonia* and *Bocydium* should not be left out of account in the attempt to solve the problem. The fact that no undoubted explanation is forthcoming is by no means surprising; and even when the living insects are studied under natural conditions it is quite likely that a solution may be long delayed. . . .

The writer hopes that Mr. Buckton's figures of species of these two genera may induce naturalists in South America to make a special effort to solve this deeply interesting problem. The observer should keep a very open mind and not neglect effects produced by communitics of individuals of the same species, nor the possibility that a single Membracid surmounted by the branching appendages of its pronotum may resemble a combination of two quite different forms, such as an ant or spider attacking or carrying its insect prey."

I will confess that they fooled me but I must confess, also, to a doubt as to *Cyphonia*'s having this bizarre thorax for the *purpose* of deception.—F. E. LUTZ.

Erebus odora.—A much battered male specimen of this species of moth was taken in the ferry house on the D. L. and W. R. R. at Hoboken, N. J., July 24, 1906.—WM. P. COMSTOCK.

A Symmetrically Deformed Dragonfly.—On the 5th of July, 1908, a number of specimens of *Libellula incesta* Hagen, were collected on the shores of Lake Hopatcong, N. J. In this species both fore and hind wings are usually about 40 mm. in length, but among those collected at the time mentioned, there was an individual with the first pair each 40 mm. and the hind pair each 35 mm. in length. The insect was thus quite symmetrically though unnaturally developed, and able to fly as well as any of its companions.—WM. T. DAVIS.

Exochomus scapularis.—This species, described by Gorham in the *Biologia*, has been found by Mr. H. A. Wenzel in the Huachuca Mts., Arizona, the date being July 24. His specimens have the elytra black, with a faint greenish tinge, and with a large, internally rounded, red humeral spot, which reaches almost to the scutellum on the base, and beyond the middle on the lateral margin. The posterior margin is also narrowly red. On account of the laminate expansion of the tibia, this species should be placed with *arizonica* in the subgenus *Arawana*.—C. W. LENG.

Sphaeridium bipustulatum Fabr.—In Canadian Entomologist, Vol. XLIII, p. 254, I recorded the occurrence of this European species on Long Island, and since then a few other records have come to my notice. While spending a few days with Colonel Robinson at West Point, I noticed in his collection a single specimen of this species

taken near his home. Mr. A. Nicolay gave me a few specimens collected by him at Upper Montclair, N. J., and Mr. F. Wintersteiner specimens from the Hackensack Meadows, N. J. I have very little doubt that this species has already a much wider distribution than indicated, and specimens are very likely mixed with the common *S. scarabaeoides* Linn.

Several varieties are recognized in Europe based mostly on the presence or absence of the subapical and subhumeral spot, color of thoracic and elytral margins or having more or less distinct rows of punctures on the elytra. The series before me, especially those from Long Island, shows great variation in size of the sub-apical spot but cannot be referred to any of the varieties except two of the New Jersey specimens which are referable to the var. *quadrivittatum* Marsh. One of these collected by Mr. Wintersteiner is colored exactly like *S. scarabaeoides* Linn. except that the large, pale, apical spot is not divided by the suture.—CHAS. SCHAEFFER.

Henicocephalus culicis Uhler.—This rare and strange Hemipteron was taken by Dr. Johannsen two years ago under circumstances which he describes as follows: "On the evening of July 5, while walking in my garden on Cornell Heights, Ithaca, N. Y., I noticed a swarm of small insects hovering in the air about six feet above the ground. From their manner of flight I supposed that they were Chironomidae, but was surprised to find that they were small Hemipterous insects belong to the strange family Henicocephalidae. During the days which followed until the last week in August I never failed to find these insects in small swarms flying in sunlight in the same locality and at about the same hour (*i. e.*, from 5 P. M. until after sundown). Of their further habits I could learn nothing, nor did I find them at any other time of day." (O. A. Johannsen, North American Henicocephalidae, *Psyche*, 1909, p. 1.)

While collecting insects on the twentieth of last April at Clayton, in the mountains of North Georgia, I met with an experience almost identical to that described by Dr. Johannsen. It had been raining a good deal, but at the time of which I write had been clear long enough for the leaves to be dry. Shortly before sunset I entered an open knoll, grown up with grass and studded with small pine trees. There I noticed swarms of tiny insects dancing up and down in the sun-

light, and which I, too, took to be Chironomidae. They did not offer to escape when I swept at them with the net, and I was both surprised and delighted to find that they were *Henicoccephalus*. They were so small that they readily passed through the meshes of the net if I did not hastily secure them in a cyanide vial, which was by no means difficult, as they remained rather inactive while in the net. On standing so that they were between me and the sky, I was able to distinguish a considerable number of these swarms, which continued until, when nearly dark, I was obliged to leave them. The number of individuals in a swarm varied from only 2 or 3 to perhaps 20 or more. I was able to secure before leaving a goodly number of specimens.

On studying them in the laboratory these insects proved to be our only known eastern species of the genus, *Henicoccephalus culicis* Uhler, previously recorded from Ithaca and Interlaken, New York, Mexico and elsewhere. Dr. Johannsen, *loc. cit.*, republishes Uhler's description and notes additional details. He also publishes very excellent figures of this species, and a table to the described North and Central American species.—J. CHESTER BRADLEY.

Calpodes ethlius on Long Island.—On the joint field meeting of the Brooklyn and New York Entomological Societies, held on Decoration Day, May 27 to 30, 1911, at Yaphauk, L. I., Mr. Geo. Franck and the writer each captured a battered specimen of this southern skipper on the flowers of lilacs. During August Mr. Michael Weiss reported the larvae as injurious to the leaves of *Canna* in the gardens of florists and in the cemetery at Glendale. Mr. Jacob Doll found both larvae and pupae abundant on the same plant at Floral Park in September and October and this also was the experience of the writer in Prospect Park, Brooklyn, in October and November. For protection, when not feeding, the larvae fold over part of a leaf and within this cover they also construct a slight web, when ready for pupation. Apparently they never wander away from their food plant. None of the adults was seen flying about, but in the breeding cage they began to emerge on the 10th of November. At the time of writing, December 3, several healthy pupae are still on hand.—GEO. P. ENGELHARDT.

A New Variety of Trogosita virescens.—Among the coleopterous material sent by Dr. Kunze, collected through middle and southern

Arizona, was a fairly long series of what seemed to be the common *Troglotis tirescens* Fabr. They were uniform in color, peacock green, and in size 13 to of an inch from tip of mandibles to end of elytra. This averages at least a fourth longer than a general series of hundreds collected from New Jersey to California. I have single specimens as large from North Carolina and Texas. In all specimens of *tirescens*, including the half dozen described varieties, reduced by Dr. Horn to synonymy, a striking and constant character is the median sulcation on the top of the head from the front, where the mandibles enter, to about two thirds of the distance to the junction with the thorax. In the other species of the genus this sulcation does not exist, the head being perfectly smooth save for the pittings. In the new Arizona material the sulcation is either wholly absent or barely discernible for a microscopic distance from the front. All things considered, a varietal name for the new creature should be introduced and I propose *nycta*, the name being an attempted mark of appreciation of the N. Y. Ent. Soc. There are differences in the elytral pittings but not much dependence is to be placed upon them on account of the variability of this character in the whole species.—R. P. Dow.

PROCEEDINGS OF THE NEW YORK ENTOMOLOGICAL SOCIETY.

ANNUAL MEETING OF JANUARY 3, 1911.

The annual meeting of the New York Entomological Society was held in the American Museum of Natural History January 3, 1911, at 8:15 P. M. President C. W. Leng in the chair and twenty members present.

The treasurer, Mr. Davis, made the following annual report:

Society Account.

Balance, January 1, 1910	\$1,141.10
Receipts from dues	100.50
Interest on deposits	35.34
Total	1,276.94
Disbursements during 1910	279.71
Balance	\$ 87.23

Journal Account.

Balance, January 1, 1910	38.52
Received, subscriptions and sale of Journal.....	387.37
Transferred from Society Account	150.00
Total	575.89
Disbursements, cost of printing and mailing Journal	514.48
Balance	61.41
Total Balance	\$1,148.70

Mr. Groth, chairman of the auditing committee, reported that the committee had examined the treasurer's books and found them correct.

Mr. Schaeffer, the librarian, made his annual report. He stated that 30 publications were received regularly as exchanges, and in addition bulletins and reports of the Bur. of Ent., U. S. Dept. of Agriculture, and of several experiment stations. Other publications had been purchased and some bound. Owing to the overcrowding of the bookcases four new sections had been purchased.

Mr. Pollard, chairman of the dinner committee, reported that the committee considered the holding of such a dinner desirable, said dinner not to exceed the cost of one dollar per plate. Motion made and carried to ask Mr. Grossbeck to confer with the Newark Entomological Society in reference to coöperating in the dinner.

Mr. Davis reported that the committee appointed to consider the Seifert collection had examined the same and advised its purchase for \$250, the money to be raised by private subscription among the members and the collection to be presented to the Museum. Mr. G. W. Angell moved that the treasurer be appointed to receive subscriptions and that the amount of \$250 be forwarded to the family of Mr. Seifert through Mr. Groth, and that if the required amount was not raised the balance to the extent of \$50 be appropriated from the Society's treasury.

Dr. Southwick, chairman of the nominating committee, presented the following nominations:

President—C. W. Leng.

Vice-President—R. C. Osburn.

Secretary—E. L. Dickerson.

Treasurer—Wm. T. Davis.

Librarian—C. Schaeffer.

Curator—F. E. Lutz.

Delegate to Academy of Sciences—E. B. Southwick.

Executive Committee—G. W. J. Angell, G. P. Engelhardt, C. L. Pollard, Chas. E. Sleight, Edw. D. Harris.

Publication Committee—Chas. Schaeffer, Wm. M. Wheeler, R. C. Osburn, F. E. Lutz.

Auditing Committee—C. F. Groth, E. L. Dickerson, F. E. Watson.

Upon motion the secretary cast a single ballot for the nominations as read.

Mr. Groth moved that a special vote of thanks be given the retiring secretary, Mr. H. G. Barber.

The president appointed J. A. Grossbeck and C. E. Olsen as a field committee.

Mr. Wheat exhibited a copy of the new Jersey List of Insects, the first copy seen by the members.

Mr. Leng, the president, gave his annual address, in which he told how the Society had advanced within the past few years, what good scientific work some of the members were doing, and suggested ways by which the members might increase the interest in the Society and the JOURNAL.

Dr. R. C. Osburn reported the capture of *Eristalis arbustorum* L., a widely distributed European form, at Fort Lee by himself and at Lakehurst by Mr. G. P. Engelhardt, and also the capture of the western *Eristalis latifrons* Loew on Long Island by Mr. Engelhardt.

Mr. R. P. Dow discussed the pronunciation of some entomological names.

Mr. Leng reported the capture of a new species of *Dineutes* at Clayton, Ga., by Mr. Davis and himself, and also a new species of Staphylinid representing a new genus taken at Roselle Park, N. J.

Mr. Davis gave some notes on the occurrence of *Tanessa milberti* in this locality.

Society adjourned.

E. L. DICKERSON,

Secretary.

MEETING OF JANUARY 17, 1911.

A regular meeting of the New York Entomological Society was held in the American Museum of Natural History, January 17, 1911, at 8.15 P. M. with President Leng in the chair and twenty-three members present.

Minutes of previous meeting read and approved.

Mr. Davis reported that \$196 had been subscribed by the members for the Seifert collection and that \$50 appropriated from the treasury would be used to make up the required amount of \$250.00.

The curator Dr. Lutz reported that the members interested were working over the Parnidae in the local collection of Coleoptera and that Mr. Grossbeck had been arranging the Coleoptera and Lepidoptera. He also announced that Mr. Leng had been appointed honorary curator of Coleoptera in the Museum.

Dr. Osburn exhibited a picture of Professor Camillo Rodain accompanying a memorial notice written by Professor Bezzi and said he would be glad to present the picture to the society for its collection. Field pictures were also presented by Mr. Sleight. Some pictures of entomologists mounted for the Society's collection were exhibited by Dr. Lutz.

Mr. Pollard, chairman of the dinner committee, stated that committees had been appointed by the Newark and Brooklyn Entomological Societies and that notices would be sent out as soon as arrangements were completed.

Mr. Schaeffer, of the publication committee, reported that plenty of material was on hand for the next number of the JOURNAL. Moved by Dr. Lutz and carried that Mr. Barber be appointed a committee of one to take charge of the short notes to be published in the JOURNAL.

Mr. Hallinan proposed Messrs. Percy Sealey, 570 W. 182d St., New York City, and Arthur E. Maiden, Gatun, Panama Canal Zone, for membership. On motion the by-laws were suspended and the Secretary cast the vote of the Society for their election.

Under scientific discussion and reading of papers Mr. Hallinan spoke on "Collecting in the Tropics," and gave his experiences in collecting in Panama. Conditions were found to be very different in the tropics and collecting more difficult. A consideration of the wearing apparel was important and an army shoulder bag containing boxes for pupæ and papered specimens was carried. A good supply of cyanide was necessary, as the material was used up rapidly owing to the climatic conditions. Certain difficulties were encountered such as red ants and fungus which attacked specimens unless the latter were kept well protected and dry. The various localities served best for collecting at different periods during the day. In the early morning from dawn to 10 A. M. the forest trails were found most satisfactory, later the hilltops, and still later the lowlands, deep forests and river banks. Each locality possessed its characteristic species. Pieridæ and other Lepidoptera were noted abundantly along the river banks, numerous Hymenoptera and Diptera around the flowering shrubs, Cerambycidæ obtained from flowers and resting on tree trunks, Hemiptera obtained both during the day and at night. The night collecting was done with lights, as sugaring gave poor results. Several boxes of the collected material of various orders were exhibited.

Concerning trouble from ants, Dr. Osburn cited an incident in the Tortugas Islands. When 200 miles out at sea he put some papered dragon flies on a laboratory table and returning half an hour later found only wings left.

Mr. Schaeffer gave some notes on Coleoptera and discussed several new and interesting species in various families, specimens of which he exhibited. He noted that *Elaphrus cicatricosus* Lec., omitted from the recent New Jersey list, really occurred in the state as in going over some material recently he found examples of this species from Ft. Lee. He also noted that *Elytroleptus floridanus* Lec. had been found on Long Island.

Mr. G. W. J. Angell exhibited a specimen of *Carabus intriatus* of Europe in which the right posterior leg was abnormal in being only one third to one half normal length. The specimen had originally come to Mr. Angell in some Museum material and he was presenting it to the Museum collection.

Dr. Lutz reviewed a paper entitled "Mimicry in Ceylon Butterflies with a Suggestion as to the Nature of Polymorphism" by R. C. Punnett. The author had studied *Papilio polytes* in its natural environment in Ceylon. He found that the two forms of the female which are believed to mimic the females of *Papilio aristolochiae* and *Papilio hector*, which are believed to be distasteful, do not so strikingly resemble them under natural conditions as when mounted. The author found that the chief enemies of the adults were not birds but lizards and Asilid flies and that butterflies supposed to be nauseous did not appear to be so to the lizards. There were also records of two Asilid flies eating distasteful butterflies. The investigation of this species seemed to point

to the fact that the forms of the female had arisen by mutation and accidentally or in some other way resembled the forms apparently mimicked.

Mr. Pollard questioned whether the enemies of the butterflies could distinguish the character of the flight and noted that there were many undoubtedly good examples of mimicry.

Mr. Leng inquired whether or not the larvæ of the models and mimics resembled each other.

Mr. Hallinan noted the fact that in the tropics many butterflies and moths closely resembled each other both in flight and habits.

Mr. Schaeffer stated that in Arizona he had found it difficult to distinguish between certain species of Lampyridæ and moths of the genus *Lycormorpha*.

Society adjourned.

E. L. DICKERSON,
Secretary.

VOL. XX.

NO. 2.

JOURNAL
OF THE
NEW YORK
Entomological Society.

Devoted to Entomology in General.



JUNE, 1912.

Edited by W. M. WHEELER.

Publication Committee.

CHARLES SCHAEFFER
F. E. LUTZ.

R. C. OSBURN.
W. M. WHEELER

Published Quarterly by the Society.

LANCASTER, PA.

NEW YORK CITY.

1912.

[Entered April 21, 1904, at Lancaster, Pa., as second-class matter, under Act of Congress of July 16, 1894.]

CONTENTS.

The Biology of Some Western Species of the Dipterous Genus <i>Ephydria</i> . By J. M. ALDRICH	77
Two Western Species of <i>Ephydria</i> . By J. M. ALDRICH	99
New Itonididae (Dipt.). By E. P. FELT	102
Foundation of Some New Genera and Species of Muscoid Flies Mainly on Reproductive and Early-stage Characters. By CHARLES H. T. TOWNSEND	107
Insects on a Recently Felled Tree. By WILLIAM T. DAVIS and C. W. LENG	119
Three New Species of <i>Belocephalus</i> from Florida. By WM. T. DAVIS	122
The Number of Moults of the Pear-slug, <i>Caliroa cerasi</i> LINNÉ. By R. L. WEBSTER	125
Notes on a Mistletoe Ant. By WILLIAM MORTON WHEELER	130
Miscellaneous Notes	134
Proceedings of the New York Entomological Society	136

JOURNAL OF THE New York Entomological Society.

Published quarterly by the Society, at 41 North Queen St., Lancaster Pa., and New York City. All communications relating to the JOURNAL should be sent to the editor, W. M. Wheeler, Bussey Institution, Forest Hills, Boston, Mass., all subscriptions to the Treasurer, Wm. T. Davis, 146 Stuyvesant Place, New Brighton, Staten Is., New York, and all books and pamphlets to the Librarian, C. Schaeffer, Museum, Eastern Parkway, Brooklyn, N. Y. Terms for subscription, \$2.00 per year, strictly in advance. *Please make all checks, money-orders, or drafts payable to NEW YORK ENTOMOLOGICAL SOCIETY.*

Authors of each contribution to the JOURNAL shall be entitled to 25 separates of such contribution without change of form. If a larger number be desired they will be supplied at cost, provided notice is sent to the Editor before the page proof has been corrected.

JOURNAL

OF THE

New York Entomological Society.

VOL. XX.

JUNE, 1912.

No. 2

THE BIOLOGY OF SOME WESTERN SPECIES OF THE DIPTEROUS GENUS EPHYDRA.¹

BY J. M. ALDRICH,

MOSCOW, IDA.

(WITH PLATES VII TO IX.)

The investigation partially covered by this paper was first suggested by a casual visit to the shores of Great Salt Lake in the summer of 1908. The large number of new observations made in a couple of hours at that time indicated the existence of a rich and almost unexplored field. Through the liberality of the trustees of the Elizabeth Thompson Science Fund, I was enabled in the summer of 1911 to visit the principal salt and alkaline lakes of the Great Basin and adjacent territory west and southwest. The present paper combines the facts gathered in both years and those previously published, pertaining to the biology of the genus *Ephydria* in the west.

The bodies of salt and alkaline water visited by me in 1911, with dates of visits, are as follows:

Box Elder Lake, Utah	July 4 and 5
Great Salt Lake, Utah—	
at Garfield (south end)	July 9
at Saltair (south end)	July 10
at Promontory Point (middle)	July 11
at Lakeside (west side)	July 12
Soda Lakes near Hazen, Nevada	July 13 and 14

¹ Being a portion of the results of an investigation carried on with the aid of an appropriation from the Elizabeth Thompson Science Fund.

Pyramid Lake, Nevada	July 16
Winnemucca Lake, Nevada	July 17
Mono Lake, Cal.	July 21 to 24
Walker Lake, Nevada	July 25
Owen's Lake, Cal.	July 28
Pacific Ocean at Santa Monica, Cal.	July 31
Lake Elsinore, Cal.	Aug. 2
Pacific Ocean at Long Beach, Cal.	Aug. 4
Borax Lake near Clear Lake, Cal.	Aug. 8
San Francisco Bay near Palo Alto, Cal.	Aug. 11

There are but four species of western *Ephydria* to report upon, as several of the names until recently in use are now known to be synonyms. All four of these are very abundant insects in their peculiar habitat, however, and one has been an important food for man. Several other species of the genus occur in the west, but their immature stages have not yet been found; so far as known they are all very rare. In another paper it is proposed to give a systematic treatment of the adults of all the western species.

Ephydria gracilis Packard.

Packard, Amer. Journal of Arts and Sciences, 3d series, I, 104, 1871,
puparium only.

B. J. Jones, Tech. Bull., Cal. Ex. Station, I, No. 2, p. 150, 1906 (adult, as
Ephydria cinerea).

Packard's original description, upon which the use of the name *gracilis* depends, is so brief that I quote it entire:

"These insects occur so abundantly where they are found, and can be so easily reared, that I venture to name another form from Great Salt Lake [the preceding had been from Clear Lake, Cal.—J. M. A.], specimens of the puparia of which have been communicated by Professor Verrill, from the collection of Mr. Sereno Watson; and by S. A. Briggs, Esq., of Chicago. It is much smaller and slenderer than any of the preceding species, the smaller specimens being .25 inch long, the largest .50 inch. The respiratory tube is much longer than in any species known to me, being in several specimens as long as the body itself; the branches into which it subdivides being over one third as long as the base of the tube. The body is of the shape of *E. halophila*, but is much slenderer, while the feet are larger and more prominent."

This description, as will be seen, consists only of a few general remarks about the puparium, comparing it with that of two other species; it would perhaps scarcely be recognizable but for the reference to the exceeding abundance of the species in Great Salt Lake. The description is especially unsatisfactory from the omission of a striking and easy mark of distinction, the basal filaments of the anal tube, which separates the species from all other American *Ephydras* of which the early stages are known. But it is certain that Packard was describing a strikingly small *Ephydra* common in Great Salt Lake, and there is but one species, whether he described it well or not.

Jones was dealing with specimens from Southern California, and was naturally unable to identify them from Packard's description. Mr. E. T. Cresson, Jr., examined Jones's types and compared them with material from Great Salt Lake; he is inclined to retain the name *cinerca* for a large variety, but my material does not justify this.

Adult (Pl. VII, Fig. 1).—Length, 2.3 to 3.5 mm.; of wing 2 to 2.9 mm. General color opaque gray, paler below and with a slight greenish tinge above; front moderately bright green; legs infuscated, knees and greater part of the tarsi yellow; wing-veins yellow at base.

Head of typical *Ephydra* shape, the face not shining below the antennae, front large, shining green except when viewed from in front with nearly frontal light, when it is ashy opaque; lower half of front with scattered minute hairs directed somewhat backward, no decussate small bristles; no noticeable impressions on front; frontal orbits pollinose, gray, with three bristles curving over the eye and a few small hairs arising between them; the edge of the front next the orbit is covered for a narrow space with a duller pruinosity; ocellar triangle pollinose, with two pairs of divergent hairs behind the single pair of large, divergent bristles; two vertical bristles each side, the inner curving directly mesad, the outer almost exactly laterad; occiput opaque, orbits not different, with only a small row of hairs. Antennae black, gray pruinose, very short, rather far apart; first joint hardly visible, second nearly as long as third, with a slender erect hair at base and a notch in apex above just behind the arista; third without lateral hair, arista almost basal, short, thick at base, moderately plumose under high power. Face almost white all over, with scattered small black hairs and a row of three or four divergent and upturned long hairs each side above the middle, extending laterally close to the lower edge; lower edge of face with quite short and thin hairs hanging down, about the same in both sexes. Cheek behind lower part of eye rather large, with small hairs and one or two somewhat larger. Proboscis thick and short, black; palpi indistinctly yellowish.

Thorax opaque gray, with scattered small black hairs and the usual

black bristles for the genus, both on dorsum and sides; scutellum somewhat elongated, convex, hairy and with four bristles; sternopleural only one; several small bristles at posterior edge of mesopleura, one larger; halteres yellow. Abdomen rather uniformly gray pruinose with a little greenish tinge, first segment short, next three of equal length, fifth a very little longer; hypopygium small, narrow, blackish, with two yellowish stiff processes projecting forward as far as the middle of the fourth ventral; the longest hairs on the abdomen are about the apex and before the incisures near the sides, but they are hardly bristle-like. Coxe and femora concolorous with thorax, the trochanters and knees yellow; tibiae varying from yellow to the color of the femora, the front ones usually paler than the others; tarsi mostly yellow, variably infuscated at tip, longer than their tibiae, the three middle joints of equal length, claws long, straight, black, no pulvilli. The hind femora have a long shining streak on the inner side, and the hind tibiae have a short shining streak at the tip behind. Wings of ordinary structure, yellowish at base, especially the veins.

Larva (Pl. VII, Fig. 2).—Length in a full-grown, average specimen, of body, 10.6 mm.; of anal tube to the fork, 4.0 mm.; of each terminal fork, 1.6 mm.; of each basal fork, 2 mm. Color white, somewhat transparent. Eight pairs of rather long prolegs, the members in each pair united in a single tubercle in the basal third, but entirely separate on the remainder of their length; in front of the segment bearing the first prolegs there are three apparent segments, the foremost retractile, containing the jaw-capsule; the jaws, as in related forms, turn down in the form of hooks, and are not opposable. Behind the last pair of prolegs the body narrows suddenly into a long anal tube, which gives off close to the base on the under side a pair of long filaments, and at its tip divides into a pair of somewhat shorter filaments. The hindmost prolegs have a longer common tubercle and a shorter divided portion than the rest.

The anal tube is considerably retractile, and varies in length in different preserved specimens. It contains two tracheæ, which continue to the terminal fork, where one leads into each branch and ends in a vestigial spiracle at the tip. I doubt if these spiracles are ever put to the surface of the water; I have not yet seen it done, so I conclude that the whole structure has changed its mode of functioning, and operates as a tracheal gill.

Puparium (Pl. VII, Figs. 3, 4).—Length of body in an average specimen, to the last prolegs, 8 mm.; anal tube so variable that it can hardly be estimated, perhaps five or six mm. would be about the usual total length beyond the last prolegs. The form of the insect is much changed from the larval stage. The thickest part of the body is in the region of the third pair of prolegs, and it tapers suddenly in front, more slowly behind, so as to be somewhat fusiform with the thickest portion well before the middle. The prolegs toward the anterior end are small; the front pair are almost indistinguishable and have no hooks; the successive pairs are each a little larger, but only the last three pairs have hooks and are of about the same size as in the larva. The last pair, which in related species hold the insect attached

during the pupal period, are here but little if at all turned forward, and do not seem to serve an important function in this species. Behind the last prolegs the base of the anal tube looks like another body segment, those preceding it being about as slender as it is; the continuation of the tube is not strongly chitinized, but thin-walled and pale in color. The diverging terminal tubes each contain a trachea, which continue separate down into the body: the pair of filaments at base of tube do not seem to have tracheæ, at least they have no vestiges of spiracles at the apices as the terminal branches obviously have. At the front end of the puparium, there is a flattened space above, well defined, extending to hind edge of the segment bearing the first prolegs—only a short space, as the anterior segments become very small as the puparium forms; this plate cracks from the front end backward along each side, and sometimes allows the escape of the fly without the breaking off of the entire anterior end of the puparium, as is supposed to be the case in the group *Cyclorrhapha*, to which *Ephydriidae* belong.

Pupa.—Upon removing the puparium, the enclosed pupa is readily obtainable. It is white in color and shows the outlines of the members of the future fly. The large proboscis is flattened down upon the prosternum; on each side of it the three legs are closely placed in regular order, and the wing follows the last leg; most of the dorsum of the thorax and abdomen is exposed, the wings being bent down along the side and of small size. It is difficult to make out many important features in the pupa, there being still one covering membrane over the future adult, and the tissues of the latter being still in an unfinished condition. The appearance is like the pupa of *E. hians*, in the half-tone, Fig. 15.

HABITS.

Distribution.—The insect is abundant in all parts of Great Salt Lake. It was reported to me by Mr. D. W. Coquillett as being represented in the United States National Museum from Salton Sea, Cal., and Tucson, Ariz. The material to which Jones gave the name of *E. cinerea* came from Southern California, without designation of locality. Recently a single specimen has been sent me by Professor C. F. Baker which was collected at Laguna Beach, Cal., which is on the Pacific Ocean. I have not learned the exact habitat of the insect in this case, but I presume it was found adjacent to some salt waters back from the sea-beach; it would be surprising to find it passing its larval stages in actual seawater.

My observations on the habits of the species were all made at Great Salt Lake, in the last of July, 1908, and the early part of July, 1911.

Egg and Early Larval Stages.—Of these I know nothing from

direct observation. Since most of the flies after maturity live on the surface of the water, the eggs no doubt are dropped directly into the water.

Food Materials.—There is an alga in the lake everywhere common, of the *Nostoc* group, its pulpy masses rolling up and down the beaches with the waves, and often forming rotting deposits of horrible odor along the upper beach as the level of the lake falls in summer. This I take to be the food of *gracilis* and also of the brine shrimp, *Artemia fertilis*, which are generally said to be the only forms of animal life found in the waters.

Habits of the Older Larvæ.—These seem to be suspended in the waters everywhere, wriggling rather aimlessly, often hard to see because of their half transparency. They do not show much disposition to keep near the surface; I could see them at a depth of two or three feet, which is as far as they could be made out on account of their delicacy. They probably occur at greater depths. That they do not come to the surface to breathe seems not to have been noted in this or any other species before, but I feel confident of my prolonged observations on this point. The long tube and its filaments must function as a tracheal gill, the spiracles at the tips being vestigial, as the anterior pair of spiracles certainly are. The pupæ show close to the anterior end the protuberant endings of a trachea on each side (Pl. VII, Fig. 7, shows the same in *hians*) so that if these and the posterior ones were functional we should have an amphipneustic larva. The anterior spiracles, however, are more vestigial than the posterior ones, and may be considered to have lost their function at an earlier period.

Puparia.—It is only in the pupal stage that the inconceivable number of these flies present in the lake begins to make an impression on the observer. The puparia are buoyant, regularly containing gas in the otherwise vacant space at the ends and around the pupa; moreover, they become attached to each other by the hardened and somewhat recurved forks of the anal tube, so that vast masses float along together. At Promontory Point I could see occasional large brown patches off shore, which I was assured were of this nature, and I was told that they were continually drifting down the Bear River Bay side of the Point, covering acres of water at a time and six inches deep, one informant said (I think he said forty acres).

The shores of the lake everywhere are more or less covered with windrows of puparia, which frequently form dark ridges that can be seen for a long distance. One of my half-tones (Pl. VIII, Fig. 8) shows the little bay on the north side, where the cutoff reaches the Point from the east. Here considerable drift accumulates, and the fly puparia form a mass filling the water close to shore, and a foot or more deep above the water for some distance; all the dark color in the water and along the edge is simply a collection of millions of puparia. The other half-tone of this subject is Pl. VIII, Fig. 9, which shows the shore on the south side of the railroad looking west. Here also the broad dark margin of the water is composed of puparia. Fig. 3 shows a small cluster of puparia held together by the diverging branches of the anal tubes. Fig. 4 is a small mass of puparia taken from a dry windrow on the beach near Garfield in 1908.

Adults.—The adults are found on the surface of the water all over the lake, but along the beaches they gather in large numbers, probably because they emerge there from the windrows of puparia that wash up. On July 31, 1908, I visited the shore near Garfield, at the south end of the lake. Near the rocks which come down to the edge of the water at the county line, I waded in and investigated the flies. At that time the surface of the water from the shore out for a distance of about eighteen feet was perfectly covered with the adult flies. They made a black belt along the beach that was visible for several miles, or as far as the shore line could be seen. They were crowded closely together, and when disturbed by my near approach they would rise only a few inches and immediately settle again. They extended up the beach a few feet above the water also, so the average width of the mass was over 20 feet. I thought that there were more than 25 flies to the square inch; in fact, double that seems a small estimate. The minimum estimate would give about 370,000,000 flies to the mile of beach.

In bathing at Saltair, I heard one bather say to his companion, "Don't go near those piles, you'll get covered with gnats." This was in allusion to *E. gracilis*, which I found on examination was present in large numbers, but as I could see it on the surface of the water everywhere it did not seem especially bad about the piles. There is occasional complaint about "gnats" by the bathers, but the flies

are very small and inconspicuous and do no harm further than to walk on people.

On the Southern Pacific cut-off west of Ogden the fly appears in a new rôle. The train-men pass through the train a few minutes before the lake is reached, shutting the windows "on account of the salt-flies," as I heard one say. It appears that the suction of the moving train raises the flies much above the usual level of their flight, and they come into open car windows by myriads. Even with care in closing the windows some will find their way in, where they become a nuisance by walking on passengers and on the tables in the dining cars. I had no difficulty in finding some of the flies in the latter situation as far west as Reno, Nevada, and I doubt not that they may be found after the cars reach Oakland. Reno is approximately 500 miles west of Great Salt Lake.

Nor is the story of *gracilis* yet completed. In the summer evenings they congregate on the rails of the cut-off to such an extent as often to stop the gasoline motors used by track-men, and even sometimes to stall freight trains. Pl. VIII, Fig. 10, shows as good a picture as I could make with a regular kodak of flies on the rails; it was taken on the morning of July 12, 1911, at Lakeside, on the western shore of the lake.

From Saltair bathing pavilion I walked ashore, and near the railroad in a little bay I found a place where the salt water had evaporated down until it was full of salt crystals. Even here the larvae of *gracilis* were active and unconcerned. I found none of them, however, in fresh water a short distance away from the lake, nor in that which was tolerably brackish, although a few adults were present sometimes at a little distance from the salt waters. Professor Voorhies at the University of Utah informed me that he had left larvae of *gracilis* in water that had evaporated down until it was covered with a crust of salt, and even in this condition the insects were active; also that he had on one occasion kept some of them in a histological fixing solution over night and for several hours of the following day, before they succumbed to the poison.¹

¹ Wilcox, in *Anat. Anzeiger*, XII, 278, describes the remarkable resistance of a dipterous larva from stagnant salt pools at Newport, R. I. He identified it with doubt as a *Helophilus*, but I suspect it may have been an *Ephydria*.

Ephydria hians Say.

Say, Jour. Acad. Sci. Phil., VI, 188, 1830. Original description of adult: habitat Mexico; reproduced in Say's Complete Works, II, 371.

Loew, Centuries of N. A. Dipt., VI, 88, 1865. Adult described as *Ephydria crassimana*; habitat Mexico.

Packard, Amer. Journal of Science and Arts, 3d ser., I, 103, 1871. Larva, pupa and puparium described as *Ephydria californica*; habitat, Clear Lake, Lake Co., Cal., supposed to be salt water; puparia from Mono Lake probably the same.

Williston, Transactions Conn. Academy, VI, July, 1883, sep. p. 4. Describes adult supposed to be that of *californica* Pack., from Soda Lakes, Nevada; notes on larvæ in these lakes and at Mono Lake, and use as food by Indians.

Williston, North Amer. Fauna (Bull. 7 pt. 2, Div. of Ornith. and Mammal., Dept. of Agric.), p. 257. Adult described as *Ephydria tarsata*, from Owen's Valley, Cal.¹

Adult (Pl. IX, Fig. 18).—Black, opaque gray all over except the front, which is shining dark green; first joint of front tarsus considerably thickened in the male. Front with scattering small hairs except in the somewhat depressed middle portion, toward the sides anteriorly with three or four pairs of bristles of different sizes, the largest decussate; the shining part of front narrowed anteriorly, and the opaque sides becoming wider; two vertical bristles on each side, the tips of the inner pair almost meeting; ocellar triangle opaque, with three pairs of bristles, becoming smaller posteriorly; frontal orbit with four curved bristles; face prominent in the middle, rather densely hairy all over, longest on the lower edge; rather bushy hairs below the eye and behind its lower part; antennæ of medium size, first joint distinct, second with an erect hair, third without a lateral hair, arista short, thick at base, nearly bare.

Dorsum of thorax with plentiful coarse hair, besides the usual bristles; many of the hairs approach the size of bristles, making the chaetotaxy confused—however it is easy to count six dorsocentrals, 3 humeral, 2 presutural, 2 large median prescutellar; scutellum with coarse hair and two pairs of bristles, sometimes another small pair between the main ones; pleura concolorous, the mesopleura, propleura and sternopleura all hairy, mesopleura with a row of bristles on hind edge, stenopleura with one bristle; metanotum and remainder of pleura bare.

Abdomen concolorous, the greenish ground-color showing through a little more than on other parts of body, both dorsal and ventral sides coarsely hairy; hypopygium of male small, generally retracted; tip of abdomen of female with the usual two spines curved backward below.

¹ In making out the above synonymy I have been aided by suggestions from E. T. Cresson, Jr., and the late Mr. Coquillett, of the National Museum. As will appear, we have to deal with a very widespread form, which has been partially described several times.

Legs wholly opaque gray pruinose, tarsi with brush-like pale hairs below, front metatarsus of male somewhat thickened, and with curled hairs on outer side, making the middle of the joint appear wider than it is; hind femur with a wide shining black area on the inner side, beginning near the base and extending beyond the middle; hind tibiae with a very narrow shining black line on the hind edge at the tip, extending up the tibia only one sixth its length. Claws very long and straight, no pulvilli.

Wings as in halftone, veins black, brownish-yellow at base; costa with a few short spinules beyond middle.

Length, 3.2 to 5.6 mm.; of wing, 3.5 to 4.5 mm.

DISTRIBUTION.

Washington: Soap Lake (C. V. Piper, in State College coll.).
Lake Como (U. S. National Museum, reported by D. W. Coquillett).

Oregon: Albert Lake (U. S. N. M.).

California: Borax Pond near Clear Lake. Clear Lake (Packard—probably was actually the same as the preceding, as Clear Lake is fresh water). Mono Lake (several collectors). Owen's Lake and Valley (several). Borax Lake and East Lake (U. S. N. M., without further information as to where these are).

Nevada: Soda Lakes (Williston). Lagoon south of Pyramid Lake (U. S. N. M.). Pyramid Lake.

Utah: Great Salt Lake (U. S. N. M.).

Wyoming: 12 miles north of Lusk (U. of Kansas coll.; no data as to body of water).

Nebraska: Salt Marshes near Lincoln (L. Bruner).

Minnesota: Red River Valley (Washburn; no data as to body of water).

Mexico: Guanajuato and Lake Texcoco (U. S. N. M.). Without locality (Say and Loew).

Pupa (Pl. IX, Fig. 15).—Specimens of these were extracted from the puparia and photographed. As in *gracilis*, they seem to present no characters of importance in classification or biology.

Puparium (Pl. IX, Fig. 16).—Length 7 mm.; of tube to fork, 2.6 mm.; of fork, 1.1 mm. Spindle-shaped, strongly tapering and up-curved in front, more gradually tapering and straight posteriorly; first four pairs of prolegs small but provided with strong hooks; last four pairs large and protuberant, the last pair largest and longest, and the hooks reversed in position; on the posterior side of this segment are some small protuberances which in some cases appear like additional but rudimentary prolegs, but they vary in development in different specimens; there are some bulging spots on the shell on

the two segments preceding this one, but they have no regular arrangement. The dorsum of the puparium is pigmented in a broad irregular vitta almost the whole length, as in the larva. The anal tube has no basal forks or filaments; the tube and its terminal forks are more uniform in length than in the larval stage, being of a hard consistency. The segment which bears the first prolegs has a flattened surface above, which continues to the anterior end of the puparium; this somewhat shield-shaped piece splits along the sides, and many of the flies emerge from the crack without pushing off the entire front end (Fig. 16, arrow) as is supposed to be characteristic of *Diptera cyclorrhapha*. The flat upper piece is readily removed, and is shown in Fig. 7. It bears at the sides the rudiments of two spiracles. The lower portion of the anterior end also readily cracks off, just behind the first prolegs, and is shown in Fig. 17; it contains the remains of the mouth-parts of the larva—a flat black sclerite embedded in the integument, and the jaw-capsule frame farther back, to the front edge of the latter being attached two long curved hooks, which in the figure seem to connect it with the former, but which really bend downward at their points. As the pupa forms it retracts from the anterior end of the shell and leaves these larval organs outside.

Larva (Pl. IX, Fig. 13).—The fullgrown larva measures about 12 mm. in length in alcoholic specimens; the length of the anal tube and its forks is highly variable and depends entirely on the amount of retraction that has taken place; generally it is much shorter in preserved specimens than it is observed to be in fresh material. The most prominent characteristic of this species is the highly pigmented stripe down the back, almost as wide as the larva, with irregular edges, narrower toward the front edge of each segment and then gradually widening to the posterior border. This pigmentation shows under the high power of the compound microscope as a covering of minute spines, a sort of shagreen; but with moderate powers it simply appears like a blackish pigment. The eight pairs of prolegs are conspicuous, as in allied forms, the last pair being much the largest, with the hooks reversed in position, enabling the insect to grasp a solid object between them and the next pair anterior, or sometimes the second pair anterior. This is a very characteristic feature of the species. The anal tube bears no filaments at base, and the apical ones emerge directly from the open end of the tube, into which they can be drawn so that only the tips are visible. The spiracles at the end of the two forks appear to be non-functional, and as in *gracilis* the organ serves as a tracheal gill.

The part of the insect anterior to the segment bearing the first prolegs is considered by Brauer to consist of five segments (Denksch. Kais. Ak. Wiss., XLVII, 39, 1883), but of these only three can be discerned, the other two being retracted in the anterior end. The second of the visible segments bears on its under surface a large, transversely oblong black spot or sclerite: this seems to be a hardened spot in the integument for the attachment of some of the muscles of the jaw-capsule. There is no true head, the retracted part being mainly the jaw mechanism. Two minute two-jointed antennae can sometimes be detected, but they are capable of retraction. The jaws are

modified so that they work vertically, as in all this group; in *hians* they are provided with a transverse row of teeth.

As in the case of other cycloraphous dipterous larvæ, distinct stages separated by moulting are not found. I have numerous newly-hatched larvæ, and a few of intermediate sizes. The youngest sizes differ from the full-grown in several minor features, especially in the absence of dorsal pigmentation and of the black plate on the ventral side of the (apparent) second segment; also in the presence of a large number of hooks in the mouth, almost like those of a pair of prolegs. These last are retractile, and not visible in some small specimens: I am unable to determine at what stage they are lost. They are well developed in larvæ 2.5 mm. long, and in smaller ones.

Egg (Fig. 11).—Length .8 mm.; width, greatest, one-third the length, least, one-fourth the length. Slightly curved; white in color. Without any hairs or appendages, quite unlike those figured by Jones for *E. millbrae*. Not attached to anything, as far as my observations go.

HABITS.

The adult flies are abundant at the edge of the water of many western salt and alkaline lakes and ponds, as indicated to some extent under distribution. I first observed them in July 31, 1908, near Garfield, Utah, on the shore of Great Salt Lake. While *gracilis* occupied all the water's edge and extended out on the surface of the lake for some distance, *hians* occurred in numbers a little farther up the lake beach, where there were windrows of rotting material that had been washed up at a higher stage of water not very long before. The two species seemed not to mix much, and my impression at the time was that *hians* bred in the rotting *Nostoc*, etc., of the windrow. On visiting the lake at several points in 1911, at a season when *gracilis* was not so overwhelming in numbers of adults, I found *hians* occasionally abundant close to the margin of the water and walking out on the surface for a few feet. Neither of these two species appears to live in water of slight alkalinity or saltiness, except when it is very close to more dense water. To illustrate, at Promontory Point I was taken to inspect a spring a mile and a half up the east side of the ridge; it was about half a mile from the lake, and several hundred feet above it. The water was only brackish to the taste, but both *gracilis* and *hians* were abundant. The small outflow was lost in the dry earth in a short distance but probably sometimes did reach the shore, giving the flies a chance to follow it up. Again, Pyramid Lake is nearly fresh water, somewhat alkaline to the taste, but probably passable to

drink in an emergency. I found *hians* in small numbers near the inlet; but this was within perhaps a mile of "Mudhen Lake," a much more alkaline pond close to the Truckee River just south of the Lake (doubtless the one called a lagoon in the distribution, above), where I was informed by an Indian that the Kootsabe was abundant—this same fly. Except in these two cases, I have not found *hians* except at the decidedly strong waters, but it appears to thrive well in both salty waters and alkaline, while as far as known at present *gracilis* confines itself to the former only. Neither fly seems to spread much from the immediate edge of the strong waters, though near Garfield I found *gracilis* a few hundred feet back from the main lake, at the edge of nearly fresh water. Professor Voorhies told me that he had not tried the experiment of rearing *gracilis* in pure water, and I did not stop long enough in a place to undertake it myself.

Adults of *hians* have the unusual habit of entering the water and walking about on objects below the surface, enveloped in a globule of air. They cannot descend unless they can have some solid object to hold to, as they are quite buoyant when below the surface. I repeatedly saw them walking in this way in Mono Lake, clinging to stones, wood, grass, cloth, or any firm substance; when they wished to come to the surface they did so by letting go and floating straight up, when the enveloping bubble bursts at the surface, and the fly is left standing unconcernedly on the top of the water. This is very common, and in one case I found eggs that had been laid on an old cloth some distance below the surface, on which I had seen numerous flies. This is not the invariable mode of laying eggs, as a great many of the flies are far from shore, over deep water, and have no way of getting below the surface. It seems pretty certain that in such a situation the eggs are simply dropped in the water while the fly rests on the surface.

The larvae are generally found near the bottom of the water. They wriggle a good deal, but do not come to the surface for air, having become modified in the same way as *gracilis* in regard to respiration. I never saw *hians* about the Saltair bathing pavilion, and think it likely that both larvae and adults generally remain rather close to shore. The food of the larvae I did not investigate, thinking that it would be a simple matter to open some of the preserved specimens and identify the contents of the proventriculus; the operation proved

very unsatisfactory, however. In Mono Lake, where I made most of my observations on this species, there seemed almost nothing in the beautiful, clear water of a vegetable nature. This larva and the brine shrimp *Artemia monica* were the only visible animals.

When the larvae have reached their full size, the outer integument hardens into the puparium. Before this takes place the insect has already assumed the fusiform shape of that stage, and has taken a firm hold on some solid object for attachment. The hold is taken by grasping the object between the last prolegs and the next pair forward, or the second pair forward. They attach to any firm object, roots of vegetation being much used. At the small Soda Lake in Nevada, I took up a piece of string out of the water which was literally covered. They often attach to each other, and sometimes an empty but still attached puparium is utilized by thrusting the last two or three segments into the open end and pressing the next prolegs against the outside. When the larva contracts into the pupa, the space left within the puparium becomes full of gas, so that the insect floats if detached, although normally it remains in the bottom of the lake. The fly on emergence is enveloped in the bubble of gas, and floats at once to the surface; this process I witnessed several times.

Mono Lake is subject to violent winds in the latter part of summer, and the disturbance of the lake loosens many of the puparia, so that they float to the surface and wash ashore. The late Professor Wm. H. Brewer, of Yale, made some observations here in July, 1863; I quote a portion of his letter to Williston (published by Williston, Trans. Conn. Acad., July, 1883):

"They drift up in heaps along the shore, and *hundreds of bushels* could be collected! They only grow at certain seasons of the year, and then Indians come from far and near to gather them for food. The worms are dried in the sun, the shell rubbed off by hand, when a yellowish kernel remains, like a small yellowish grain of rice. This is oily, very untritious, and not unpleasant to the taste, and, under the name of *koo-chah-bee* (so pronounced), forms a very important article of food. . . . My guide, an old hunter there, told me that everything fattens in the season of *koo-chah-bee*; that ducks get very fat, but their flesh tastes unpleasantly from it, and the Indians get fat and sleek."

My stay at Mono Lake was July 21-24, 1911, and I was informed

that the collection of the fly for food would not begin until about September 1. None was left over from the previous year, so I was disappointed in seeing either the material after preparation or the process of putting it up. However, I talked with both Indians and whites about it. There are only a few Indians who collect the material now, although it is known among all the older Indians of the tribe. The name of the food is better spelled "koo-tsabe," accented on the first syllable, the last two letters forming an obscure syllable in which it is hard to distinguish whether the consonant is b or v. "Fat Joe" pronounced it for me many times and I listened very attentively; when I told him it had not been so recorded by earlier investigators, he chuckled and replied in his free and easy English, "Well, you understand I'm giving you the real thing." White people at the lake emphasized the amount of time required to free the little dried pupae from bits of puparium, dirt, etc.; they thought it hardly worth while for anyone to work at it whose time had any value.

Most of the Pah-Ute Indians are now on reservations, one south of Pyramid Lake and one at the north end of Walker Lake, and only a few live near Mono Lake, where they eke out an existence on koo-tsabe, dried caterpillars (which I have reported on elsewhere) and pine nuts, adding a minimum of white man's "groceries."

The accompanying half-tones of the pupae will give some idea of the food material that the fly makes. It has been reported that it was also collected thirty or more years ago by Indians of the same tribe at the two small soda lakes near Hazen, Nevada.

The loss of my camera with all my exposed films in it, while I was at Mono Lake, makes it impossible for me to give any illustrations except from the material brought home—much to my regret, for the lake and surroundings are very beautiful and picturesque.

The main centers of this species might be said to be Mono Lake, Owen's Lake, and Great Salt Lake—in all three they are exceedingly numerous.

I cannot forbear to include a brief extract from Mark Twain's "Roughing It," about the characteristic fly of Mono Lake, as it is true to life: "You can hold them under water as long as you please they do not mind it—they are only proud of it. When you let them go, they pop up to the surface as dry as a patent-office report, and

walk off as unconcernedly as if they had been educated especially with a view to affording instructive entertainment to man in that particular way."

In Williston's Manual of North American Diptera, 2d edition, 1896, p. 109, there is a quotation from a letter written by Professor Penafiel, referring to a species said by Williston to be *E. hians*, which is used as food at Lake Tezeuco, an alkaline lake about a hundred miles west of Mexico City. The quotation follows:

"It is of the eggs of this insect that the greater part of what is known as Ahuatle is composed and which is now used by the natives who have preserved the customs of the ancient Aztecs. The eggs are cleaned and ground into flour, and are prepared by mixing with hens' eggs and fried with fat into small cakes. The larvæ are also used as food under the name of Puxi."

Packard, in a footnote to his second paper on "Insects Inhabiting Salt Water," quotes something similar from a book called "Anahuac," by E. B. Taylor, published in London, in 1861. The quotation is as follows: "A favorite dish here (Tezeuco) consists of flies' eggs (*Corixa femorata* and *Notonecta unifasciata*, according to Menneville and Violet d'Aoust) fried. These eggs are deposited at the edge of the lake, and the Indians fish them out, and sell them in the market place. So large is the quantity of these eggs that at a spot where a little stream deposits carbonate of lime, a peculiar kind of travertine is forming which consists of masses of them imbedded in the calcareous deposit." Packard adds without specifying his authority, "The flies which produce these eggs are called by the Mexicans 'Axayaacatl' or 'water face.' The eggs are sold in the market, pounded and cooked, and also in lumps *au naturel*, forming a substance like the roe of a fish. This is known by the characteristic name of 'ahua-utli,' that is, 'water wheat.'"

It seems that the Diptera and the Hemiptera are mingled together in the quotations; only an investigation by an entomologist at the lake can clear up the confusion. Probably the egg state is not used in either insect.

There remains only a brief note to add about the identity of Packard's *Ephydria californica*. After I learned that Clear Lake is a body of fresh water, not salt as Packard supposed, I inquired about any small bodies of alkaline water in the vicinity; in fact, Professor

A. J. Cook, now Horticultural Commissioner of California, told me of one before I could ask him. Later Dr. E. C. Van Dyke gave me full directions about reaching the place. It is a small, strongly alkaline pond close to the shore of Clear Lake, some three or four miles south of Soda Bay, and is called Borax Pond or Borax Lake. I made a special trip from San Francisco, taking two days' time, and was successful in collecting *E. hians* at this borax pond. This, I think, makes it reasonably certain that *californica* is a synonym of *hians*.

Ephydria subopaca Loew.

Loew, Centuries, V, 99, 1864. Adult described from Connecticut.

Packard, Proceedings of the Essex Institute, VI, 46, 1868 (issued March, 1870); puparium and adult described as *Ephydria halophila*, a preoccupied name; from brine at Equality Salt Works, Gallatin Co., Ill. Synonymy by Coquillett, *in litt.*

Johnson, Proc. Acad. Nat. Sciences of Philadelphia, 1895, 339, occurrence at Charlotte Harbor, Fla.

Smith, Catalogue Insects of New Jersey, 1899, 693, occurrence in New Jersey; second edition, 1909, 807, same, several localities.

Johnson, Entomological News, XV, 163, 1904, oc. at Atlantic City and Seaside Park, N. J.

Adult (Pl. VII, Fig. 5).—A yellow-legged species with rather dense yellow pollen, front metallic blue-green, the fifth segment of the abdomen in the male nearly twice as long as the fourth.

Front metallic blue-green, bright, in the female with a pair of small decussate bristles on the lower part of the front and several hairs above and below these as well as a few scattering small hairs along the sides of the shining portion; in the male these hairs and bristles of the front are little developed; three orbital bristles, with hairs intermingled; two verticals each side; behind the main pair of ocellar bristles are two pairs of hairs; orbits yellow-pollinose. Face yellow-pollinose, with a small shining bluish spot in the median line below the antennæ, covered with small black hairs and two transverse rows of bristles, one of which is directed downward along the margin of the mouth and is composed of long bristles in the female; the other follows the upper edge of the protuberance and the bristles bend outward and upward, especially those near the middle. Eye small and oblique, one large bristle on the broad cheek. Palpi yellow. Thorax yellow pollinose, dorsum a little shining in some specimens (when abraded), covered with small black hairs. Dorsocentrals 4 (1 before the suture), prescutellars one median pair, humerals 1 and several hairs, posthumeral 1, presutural 1; scutellar two pairs; before the scutellum the hairs are noticeably long. Mesopleura hairy except on the front part, on its hind edge with a row of long hairs and one bristle; stenopleura hairy and with one bristle. Tegula yellow, with abundant pale

yellow silky hairs. Halteres yellow. Abdomen concolorous with thorax or more greenish, with black hairs, longer on the posterior edge of the segments, fifth segment in male nearly twice as long as fourth on dorsal side, ventrally it is entirely cut away to receive the large hypopygium, which has a pair of yellow processes extending forward one third the length of the fourth segment. Legs usually yellow, middle and hind coxae blackish, tarsi somewhat infuscated toward the tip; front femora with some bristles on the outer and upper side; hind femora with a long shining area on the inner side, destitute of hairs, extending the whole length; hind tibia with a narrow shining streak on the hind side, from below the middle to the apex. Wings yellowish, veins yellow on basal half.

Length, 4 to 5 mm.; of wing, 3.5 to 4.5 mm.

This species varies in several ways: the yellow color of the pollen may vary to whitish, especially on the face; the color of the legs may be considerably infuscated, especially on the femora; the hairs of the front may vary considerably in size; and the shining spot on the upper part of the face may be absent. As all these variations may occur in a lot taken together, they do not indicate specific differences.

Larva.—My material is far from abundant, but will allow a comparative description with *hians*. The larva of *subopaca* differs in not having the dorsal pigmentation and the black integumental plate below the retracted jaw-capsule. The color is almost white, but the tips of the forks of the anal tube are very black, contrasting more with the general color than in *hians*. There are no basal filaments from the anal tubes. The proportions of body and tube are about as in *hians*, but the size a little smaller.

Puparium.—There are faint pigmented spots on the dorsum. The sixth and eighth pairs of prolegs are uniformly large, the last with hooks directed forward; these two pairs are used in grasping a support while in the pupal period, the anterior five and the seventh being small but with good-sized hooks. The color of the integument varies but is generally light, and in many specimens the macrochaete of the pupa can easily be seen through the puparium—often indeed small hairs as well. The flat or concave region of the anterior end above is strongly marked, and the rudimentary spiracles stand out laterally on the (apparent) first segment, their protruding part divided into three or four processes.

DISTRIBUTION.

Massachusetts: Woods Hole (Melander).

Connecticut (Loew).

New York: Ithaca, at salt pond (Johannsen).

New Jersey: several localities (Smith Catalogue).

Illinois: Gallatin Co., at salt pond (Packard).

Utah: Box Elder Lake (salt). Garfield (brackish seepage). Promontory Point (brackish spring).

Idaho: Market Lake (overflow from irrigating ditch).

Nevada: Hazen (overflow from irrigating ditch). Winnemucca Lake (alkaline). Walker Lake (alkaline).

California: Mono Lake (seepage near lake).

Washington: Soap Lake, Grand Coulee (alkaline).

HABITS.

Comparing my observations of this species with those on the two preceding, a striking difference appears in the density of the water in which they live, as *subopaca* occurs only in the less dense waters, often in those with a specific gravity scarcely more than 1. The other two, as already stated, seem not to occur except in the dense water or near it.

In Box Elder Lake, a shallow expanse of slightly salty water two miles north of Brigham, Utah, I found this species, the first *Ephydria* of my trip. Using a hydrometer, I attempted to find out the density preferred by the species, and here I learned my first lesson, emphasized all the way afterward—that in all these bodies of salt and alkaline water, the density is subject to great fluctuations, and the insects are able to adapt themselves to these. Along the side of the railroad grade a stream of waste irrigating water ran into the lake; it was possible to find all densities from 1 to 1.019, and the larvae of the fly, though not numerous, seemed at home everywhere, or at least to a density of 1.001. A few days later, near Garfield, Utah, *subopaca* was found around waste water, sp. gr. 1.00; but it was seepage that perhaps contained too little alkaline matter to be detected by my instrument. I have recorded under distribution several cases like this, and the interesting question is still unsettled whether some small amount of salt or alkali is not a necessity in water that is to support larvae of this species. The adults are often found at fresh water if it is near a denser supply; in the road near the Mono Lake post-office this was especially in evidence, where there was a seepage of very pure water with plenty of *subopaca* adults standing on it (the adults generally stand on the water, not on the shore).

At Bodie, Cal., an old mining camp on the top of a mountain range at an elevation of 8,400 feet, there were specimens of what I took to be this species (certainly an *Ephydria*) standing on the surface of reddish seepage water from a manure pile.

It is everywhere more difficult to find the larvae of this species than of the two preceding; I found them only twice. This may be on account of the adults moving farther from the place of emergence than in the other species, or possibly they form more distinct broods, so that no larvae are left behind, but all transform nearly together.

Packard's notice of what he called *halophila* contains the following quotation from his correspondent (E. T. Cox) at the Equality Salt Works:

"I send you the larva and pupa of a dipterous insect (*Ephydria*) found in the brine at the salt works near Equality, Gallatin Co., Ill., in such prodigious quantities as to fill up the wooden conduit pipes. These larvae [puparia—Packard] are gregarious, collecting in masses and form great rope-like bunches by clinging around small fibrous roots on the sides of the little ditch that conveys the brine from the first 'Graduation or Thorn House,' to the pump at the furnace. The brine as it comes from the well has a strength equal to 7.3 Baumé, and is graduated after the German plan, by showering it successively over thorn bushes arranged on beams from top to bottom of three separate frames, from forty to forty-five high, called 'Graduation or Thorn Houses.' What is remarkable in this is, that the above larvae can nowhere be found except in the brine after first gradation, that is, passed over the first house, where they are found in such quantities as to prove a great nuisance."

A similar case is reported to me from brine pools near the salt works at Ithaca, N. Y., by Dr. O. A. Johannsen, now of the Maine Experiment Station, who sent me specimens for identification. The larvae in this case were found in pools of varying density, ranging from 1.5 to 6.5 grams of salt per liter of water. The noticeably greater density of the water in the case quoted by Packard is as yet unexplained; no further observations at that place have been made.

Ephydria Millbrae Jones.

Jones, Tech. Bull. Cal. Ex. Sta., Vol. I, No. 2, pp. 155-159, 1906. Adult, pupa, puparium, larva and egg described; several figs. Breeding in salt marshes on southwest side of San Francisco Bay, Cal.

This species (Fig. 6) is closely allied to *subopaca*, if not even identical with it. The primary difference in the adult is the darker color of the legs, the femora being dark greenish with a slight metallic

luster, the tibiae yellow with infuscated tip, the tarsi infuscated. The average of size is slightly larger, and the hairs and bristles are slightly longer, than in *subopaca*. The color of the pollen over the body is more greenish in *millbrae*, yellowish in *subopaca*. Occasional specimens with lighter pollen and yellow legs occur in *millbrae*, the lightest ones corresponding exactly with the other species; just as, among the *subopacas* of the interior, dark-legged specimens are occasionally seen. In either case 98 per cent. or so are true to type. As I have not studied the larva and puparium of *millbrae*, I feel that it would be premature to assert the identity of the two species.

The puparium as figured and briefly described by Jones seems to be the same as in *subopaca*. His figure and description of the larva indicate a small amount of dorsal pigmentation and a larger development of the anterior spiracles, but the examination of material in both species would be needed to determine whether a specific difference exists here. The egg according to Jones is shaped like an apple-seed, and has tufts of minute hairs on its surface; it is attached by its larger end to floating bits of vegetation or puparia.

DISTRIBUTION.

Jones mentioned portions of San Francisco Bay, from San Mateo to San Bruno. I have collected it in the following localities:

Salt marshes of S. F. Bay adjacent to Palo Alto, in February, April, August and October.

Alum Rock park, near San Jose, Cal., 20 miles or so from the bay, April 5.

Santa Monica, Cal., July 31.

San Juan Island, Wash., several places, May to July.

Professor C. F. Baker sent me a specimen collected at Laguna Beach, Southern Cal.; while I am indebted to Professor Melander for specimens taken May 17 at Olga, on Orcas Island, Wash.

HABITS.

The species keeps close to the seashore. The Alum Rock record above is the only apparent exception, and there the park with numerous mineral springs is traversed by a stream which empties, or at one time did, into San Francisco Bay.

Jones says: "Like mosquitoes, they seem unable to breed in water affected by the tide, but prefer the smaller pools that are practically without motion. . . . I have found the flies living in ponds where the salinity was as high as 4.2 per cent., being almost one per cent. higher than that of average sea water. . . . The adult flies abstract their nourishment from the surface of the water in which their larvae live. They are especially fond of decaying animal matter, and will collect in swarms on water containing dead crabs or other animal bodies."

At Santa Monica the species was abundant July 11, 1911, on the surface of a pool at the mouth of Santa Monica Creek. The creek is small, and disappears in the sand as it approaches the beach. Here there was a pond some 15 feet wide and 70 long, with no visible outlet or inlet, on which were the flies, but in which I could find no larvae even in prolonged search.

EXPLANATION OF PLATES.

PLATE I.

- Fig. 1. *Ephydria gracilis* Pack., adult ♀, $\times 8$.
- Fig. 2. *Ephydria gracilis* Pack., nearly full-grown larvae, $\times 4\frac{1}{2}$.
- Fig. 3. *Ephydria gracilis* Pack., cluster of puparia hanging together by anal tubes, $\times 3$.
- Fig. 4. *Ephydria gracilis* Pack., mass of dried puparia from Great Salt Lake beach, slightly reduced.
- Fig. 5. *Ephydria subopaca* Loew, adult ♀, $\times 8$.
- Fig. 6. *Ephydria millbrae* Jones, adult ♀, $\times 8$.
- Fig. 7. *Ephydria hians* Say, dorsal anterior dehiscent portion of puparium, enlarged (see Fig. 16, arrow).

PLATE II.

- Fig. 8. Looking east from Promontory Point, Utah, along the S. P. cut-off. The dark material collected in the bay in the foreground is *Ephydria gracilis* puparia.

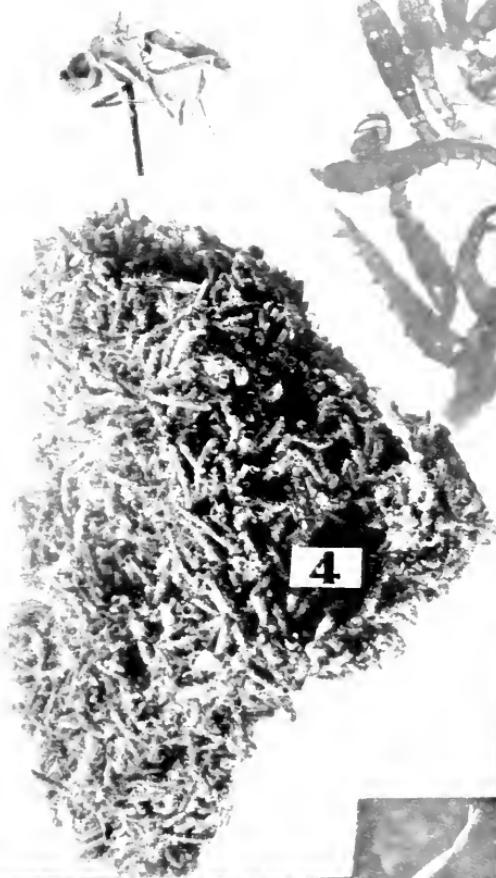
Fig. 9. Looking west on the south side of the railroad near Fig. 8. The puparia of *gracilis* form the dark deposit along the edge of the water.

Fig. 10. *Ephydria gracilis* on railroad rails at Lakeside, Utah; the near rail on the right is focused best.

PLATE III.

- Fig. 11. *Ephydria hians* Say, eggs, $\times 40$.
- Fig. 12. *Ephydria hians* Say, young larva, $\times 24$.

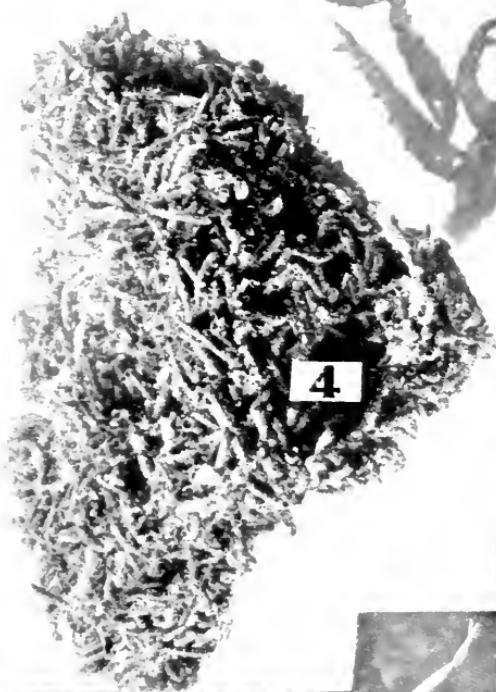
1



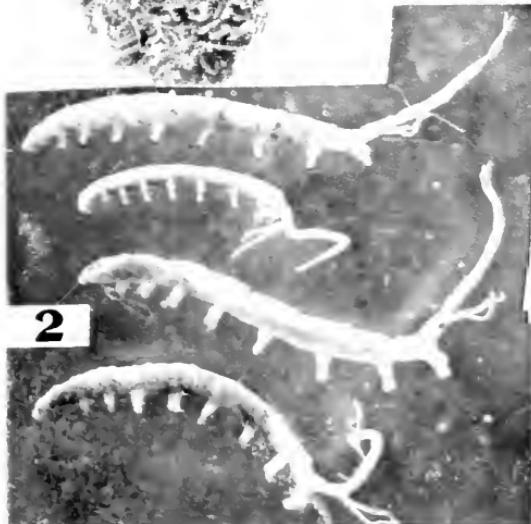
3



4



2



5



6



7



Western Ephydra.



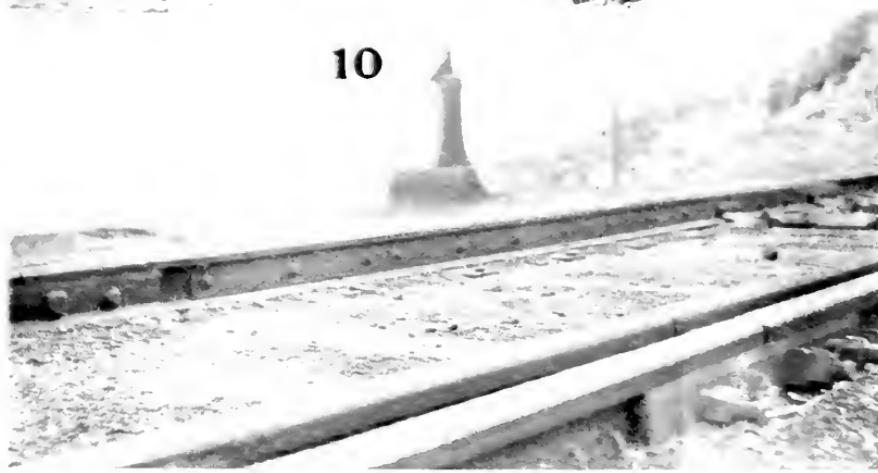
8



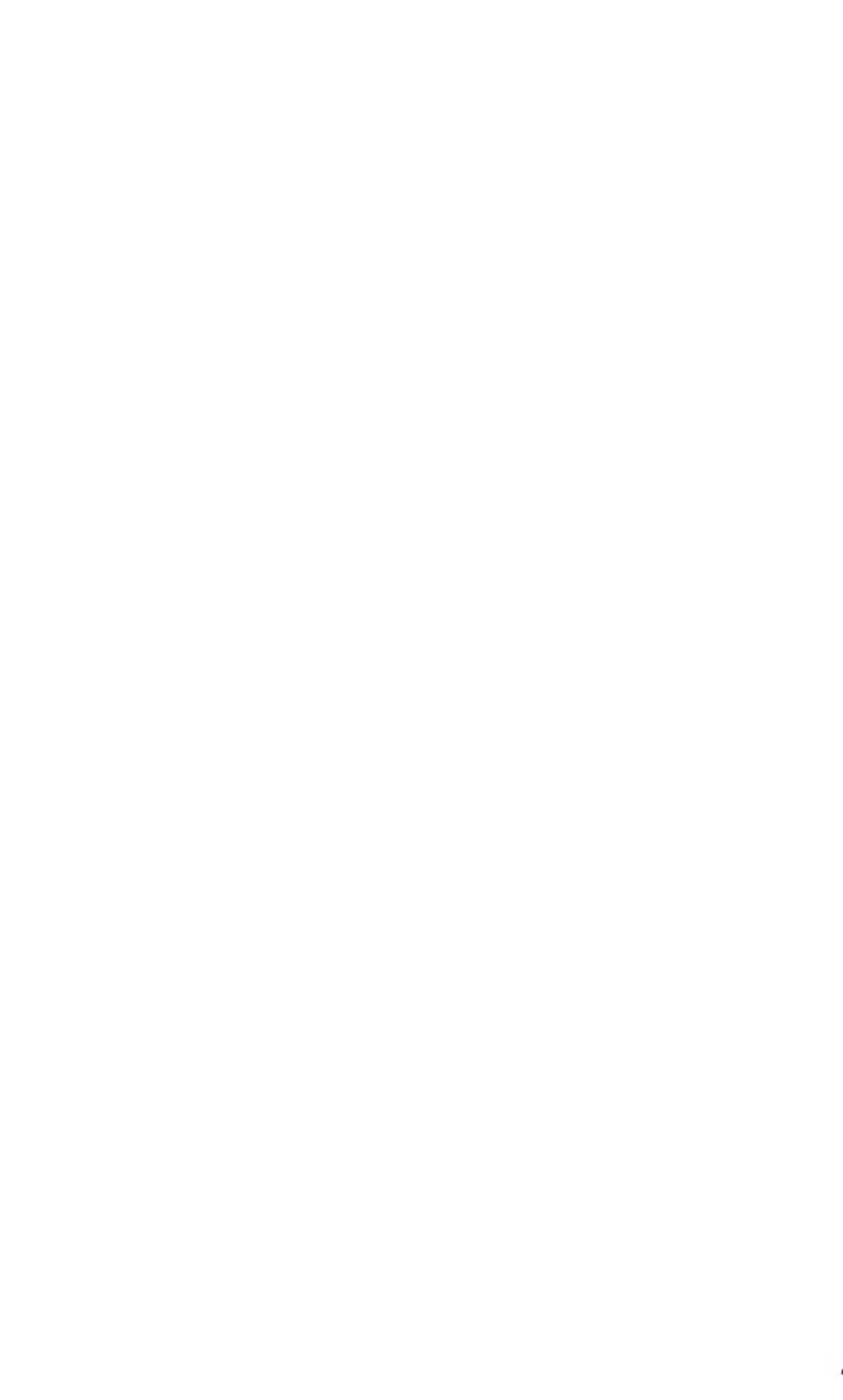
9



10



Western Eng. dir.





11



12



13



14



15



18



16



17

Western Ephydra.

Figs. 13, 14. *Ephydria hians* Say, full-grown larvae. - 4.

Fig. 15. *Ephydria hians* Say, pupæ. - 5.

Fig. 16. *Ephydria hians* Say, puparia. - 3.

Fig. 17. *Ephydria hians* Say, ventral anterior dehiscent portion of puparium, containing the larval mouthparts (see arrow, Fig. 16).

Fig. 18. *Ephydria hians* Say, adult ♀. - 8.



TWO WESTERN SPECIES OF EPHYDRA.

BY J. M. ALDRICH.

MOSCOW, IDAHO.

As a completion of the preceding article I append the description of a new species of *Ephydria* that I know only in the adult stage, which was collected while investigating the shores of Great Salt Lake last summer, together with a redescription of *E. viridis* Hine. Both species are strongly marked and easily recognizable. There is also added a table for the separation of the western species. The only name occurring in it besides these two new species and the four mentioned and described in the preceding paper is *atrovirens* Lw., which I have collected in the vicinity of Moscow, Idaho.

Ephydria auripes new species.

Male.—Opaque green, the front except orbits and ocellar triangle, and the posterior half of the mesonotum with the scutellum, intensely shining blue-green or bronze-green; legs dark green, all the tarsi wholly golden yellow.

Ocellar triangle and wide frontal orbits velvet-black, rest of front intensely shining blue-green, three fronto-orbital bristles curving over the eye, besides the outer vertical bristle which does the same; antennæ small, black, second joint robust, third small, arista with only slight and faint plumosity, prominence of face very high, long and vertical in front, with a nearly bare spot above the prominence and just below the antennæ, which is sub-shining blue, the rest of the face whitish pollinose, hairy, with small bristles along the mouth and a slight row of bristly hairs across the upper part. Proboscis and palpi blackish-green.

Thorax semi-opaque greenish, changing to brilliant bronze-green behind; at the sides the change comes suddenly at the suture, on the disk gradually and farther back; scutellum also brilliant bronze-green. Chætotaxy of thorax normal, the bristles well developed. Pleuræ opaque, one rather strong bristle in the row of bristly hairs on the hind edge of the mesopleura; one sternopleural; knob of halteres bright yellow.

Abdomen sub-shining metallic blue, fifth segment nearly a half longer than the fourth, hypopygium very small and retracted.

Legs opaque greenish-black, knees hardly yellowish, tarsi strongly contrasting deep yellow, only the tip of the last joint a little infuscated; claws black, long and straight.

Wings of ordinary appearance, veins rather pure yellow near base.

Length 3.6 mm.; of wing 3.5 mm.

A single made, Garfield, Utah, July 9, 1911. The specimen was not recognized as different from *subopaca* until after the work of the day was finished, and I am unable to state just where I got it. I collected along brackish water from Smelter station west and north to the shore of Great Salt Lake, and captured the specimen in that small region.

The species has so many good marks of distinction that it will be recognized without difficulty.

***Ephydria viridis* Hine.**

Cænia virida Hine, Ohio Naturalist, IV, 65.

A large, robust, dull-green species with yellow knees, a deep depression in the front just anterior to the ocellar triangle, and ornamented hind tarsi in the male.

Male.—Front shining dark green except the wide orbits and the ocellar triangle, which are seal-brown pollinose; a deep depression just in front of the foremost ocellus; a few minute hairs on the shining portion of the front, and on the lower corners one pair of bristles, curved toward each other; the frontal orbits bear two pairs of f. o. bristles bending outward over the eyes, and a few hairs extending down to the face. Antennæ black, third joint large, arista with distinct, short plumosity. Face moderately prominent, convex in profile, covered with brown pollen; the antennæ are wide apart, and the space below them is only a little less pollinose; hairs of face coarse, with a row of little bristles across above and another along the oral opening. Sides of face, cheeks and back of head with brown pollen; below the eye a bare space extends to the mouth, and behind this is a large bristle on the edge of the mouth, behind which the beard begins.

Thorax dark shining green, with a little thin brown pollen; hairs rather small, bristles strong, chaetotaxy normal except that there is no post-humeral (interhumeral); pleurae with a little more pollen, which becomes olivaceous on the sternopleura; one large bristle and a few small ones on the posterior edge of mesopleura; calypter moderately large, yellow and with brownish yellow hairs; halteres yellow.

Abdomen green, sub-shining, fifth segment nearly a half longer than fourth, hypopygium very small and inconspicuous.

Femora and tibiae all sub-shining greenish-black, the knees decidedly yellow, trochanters sometimes a little yellow; front and middle tarsi of plain

structure, more or less yellow at base; hind femora incrassated, with long hairs below near base, their tibiae noticeably curved, long-hairy on the inner side toward the end, shining black on the apical half of the hind and inner side; hind tarsi short, with the usual brush of yellow hairs below on three joints and a few long hairs above, directed mesially; fourth joint a little longer than the third, with a process toward the apex on the inner side, which bears a conspicuous tuft of black hair; fifth joint normal.

Wing brownish, veins brownish yellow at base, costa a little spiny, hind crossvein somewhat oblique and bicurved.

Length 6.2 mm.; of wing 5.6 mm.

Female.—Greatly resembling the male in all points but the hind femora scarcely thickened, the hind tibiae nearly straight, the hind tarsi a little longer than in the ♂, plain, with only three or four bristles above. Length 6.5 mm.; of wing 5.6 mm.

Five males and one female, collected on the salt marshes of San Francisco Bay, Cal., adjacent to Palo Alto, April 20 and 26, 1906. I searched in vain for additional material in August, 1911. Nothing is known about the life history.

This species was originally described from Brownsville, Texas. The generic reference might be argued either way, as the claws are not very straight, and very minute pulvilli are present. Hine's description is meager, and I did not suspect the identity of my material until I learned from E. T. Cresson, Jr., to whom I sent part of it, that he had compared it with the types of *viridis* and found them identical. I have therefore given a fuller description of the species.

TABLE OF SPECIES.

The described species of *Ephydria* from the region of the Rocky Mountains and westward may be tabulated as follows:

1. With 6 dorsocentrals; a large gray opaque species, front hairy and with several bristles inclined mesially on the lower part.....*hians* Say.
- With 5 dorsocentrals; front with 1 pair of small bristles below, inside the orbita, or with none
2. Frontal orbits shining; 3d joint of antenna with a long erect hair on outer side.....*atrovirens* Loew.
- Frontal orbits pollinose; 3d joint of antenna without such a hair 3
3. Tarsi bright yellow, contrasting with the black-green femora and tibiae.
auripes Aldrich.
- Tarsi not contrasting with tibiae
4. Very large bronze-green species with yellow knees; ♂ with a conspicuous tuft of hairs on inner side of 4th joint of the hind tarsus, *viridis* Hine.
- Not as described; ♂ not ornamented

5. Very small opaque gray species with shining front; the hind crossvein rectangular to the costa *gracilis* Packard.
 The hind crossvein oblique to the costa 6
 6. Femora yellow (in western specimens almost always); inland species.
 subopaca Loew.
 Femora blackish; occurs only adjacent to tide-water of the Pacific.
 millbrae Jones.
-

NEW ITONIDIDÆ (DIPT.).

BY E. P. FELT,

ALBANY, N. Y.

The species described below comprise some of the more interesting forms recently submitted for study. This is especially true of the remarkable *Johnsonomyia* and the *Camptomyia*, the latter being the only female representative of this genus we have seen.

Campylomyza truncata Felt.

Male.—Length 1 mm. Antennæ a little longer than the body, thickly haired, reddish brown; 14 segments, the fifth with a stem as long as the pyriform basal enlargement, which latter has a length twice its diameter, obtusely rounded. Palpi; first segment broadly oval, second quadrate, with a length twice the diameter, third roundly quadrate, shorter than the second, the fourth $\frac{1}{2}$ longer than the third, more slender. Mesonotum and scutellum dark reddish brown, postscutellum and abdomen a little darker. Halteres yellowish basally, fuscous apically. Legs mostly fuscous yellowish, the distal tarsal segments darker; claws stout, strongly curved, denticulate, the pulvilli as long as the claws. Genitalia; basal clasp segment very short, broad; terminal clasp segment stout and quadrately rounded apically; dorsal plate short, broad, the very short lobes obliquely truncate. Harpes stout, truncate, the distal margin and latero-distal spines heavily chitinized. Type Cecid 1404.

This species, near to *C. flavoscutata* Felt and *C. modesta* Felt, was collected April 17, 1910, by Dr. W. G. Dietz, Hazelton, Pa.

Corinthomyia gracilis, new species.

Male.—Length 1.5 mm. Antennæ extending to the 4th abdominal segment, sparsely haired, dark brown; 14 subsessile segments, the fifth with a stem $\frac{1}{2}$ the length of the cylindric basal enlargement, which latter has a length nearly twice its diameter and 4 or 5 short, stout whorls; terminal segment reduced, tapering, with a conical appendage apically. Palpi; first segment broadly oval, the second rectangular, with a length over twice its diameter, the third $\frac{1}{2}$

longer than the second, the fourth $\frac{1}{2}$ longer than the third, slender. Body a nearly uniform dark reddish brown. Halteres and legs mostly yellowish transparent; claws stout, strongly curved, the pulvilli longer than the claws. Genitalia; basal clasp segment stout, truncate; terminal clasp segment narrowly oval, somewhat swollen distally; dorsal plate short, the lobes broadly rounded. Harpes heavily chitinized, broadly and roundly emarginate, the broad lobes roundly truncate. Type Cecid 1405.

This species was taken May 18, 1910, at Hazelton, Pa., by Dr. W. G. Dietz. It is most easily recognized by the more slender antennæ and the smaller number of whorls on the fifth antennal segment.

Johnsonomyia cincta, new species.

Female.—Length 5 mm. Antennæ with at least 12, and probably 16 segments, presumably nearly as long as the body, thickly haired, yellowish orange, the fifth with a stem $\frac{3}{4}$ the length of the cylindric basal enlargement, which latter has a length nearly $2\frac{1}{2}$ times its diameter, is distinctly constricted near the middle and has broad, scattering subbasal and subapical bands of moderately coarse setae. Palpi yellowish, the first segment slender, with a length $2\frac{1}{2}$ times its diameter, the second narrowly oval, a little longer than the first, the third narrowly oval, a little shorter than the second, the fourth slender, somewhat irregular and with a length fully twice that of the third. Eyes large, black, fused. Mesonotum yellowish white, with indistinct magenta reflections. Scutellum yellowish transparent, postscutellum yellowish white. Abdomen reddish yellow, the basal segments somewhat darker dorsally and sparsely clothed with white hairs. Wings subhyaline, with a broad, indistinct, fuscous band across the middle of the wing, particularly marked on the veins; subcosta from its union with the third to its apex, the crossvein, the third vein to a point opposite the tip of subcosta and a corresponding area on the simple fifth vein being more or less fuscous. Venation nearly as in *J. rubra* Felt. Halteres yellowish basally, slightly fuscous apically. Coxæ pale yellowish; femora light straw; tibæ white basally, the distal fourth pale straw; tarsi, first segment whitish basally, the distal third pale straw, the second tarsal segment mostly whitish, the distal third pale straw, the third and fourth segments whitish, the fifth variably tinged with yellowish or yellowish brown, especially apically. Claws stout, slightly curved, simple, the pulvilli rudimentary. Ovipositor short, the lobes indistinctly triarticulate, the first and second subquadrate, slightly fused, the third roundy triangular and thickly setose. Type Cecid a2260.

This large and strikingly colored midge was taken on the Polochic River, Guatemala, February 22, 1912, by Messrs. Barber and Schwarz.

Asynapta americana, new species.

Male.—Length 1.5 mm. Antennæ as long as the body, thickly haired, dark brown; 21 segments, the fifth with a stem $\frac{3}{4}$ the length of the basal enlargement, which latter has a length $\frac{1}{4}$ greater than its diameter; the subapical

whorl of setæ long, extending to the apex of the following segment; distal segment reduced, irregularly conic, sometimes narrowly fused with the preceding. Palpi: first segment subquadrate, the second irregular, with a length over twice its diameter, the third $\frac{1}{2}$ longer than the second, stout, the fourth $\frac{1}{2}$ longer than the third, slender. Mesonotum dark brown, the submedian lines sparsely haired. Scutellum and postscutellum yellowish. Abdomen sparsely haired, fuscous yellowish. Halteres yellowish. Coxæ and femora basally yellowish, the remainder of the legs fuscous straw. Genitalia: basal clasp segment stout; terminal clasp segment narrowly oval; dorsal plate long, broadly emarginate, the lobes broadly rounded; ventral plate short, deeply and roundly emarginate, the lobes rather long, narrowly rounded. Harpes chitinous, complex, style slender. Type Cecid 1399.

This male was taken by Dr. W. G. Dietz, April 13, 1910, at Hazelton, Pa. It is easily separated from allied forms by the shorter stems of the antennal segments.

Camptomyia æstiva, new species.

Female.—Length 1.5 mm. Antennæ nearly as long as the body, sparsely haired, light brown; 21 segments, the fifth with a stem $\frac{1}{4}$ the length of the cylindric basal enlargement, which latter has a length $2\frac{1}{2}$ times its diameter and a sparse whorl of long setæ; terminal segment produced, with a length over twice its diameter and tapering to a narrowly rounded apex. Palpi: first segment with a length $2\frac{1}{2}$ times its diameter, the second $\frac{1}{2}$ longer, stout, the third with a length twice that of the second, slender, the fourth about as long as the third, more slender. Mesonotum reddish brown. Scutellum yellowish, postscutellum dark brown. Abdomen sparsely haired, yellowish orange, the rather stout ovipositor with the distal five segments recurved over the back. Halteres pale yellowish. Legs pale straw; claws stout, strongly curved, unidentate, the pulvilli as long as the claws; terminal lobes long, triarticulate, the apical segments with a length nearly thrice the diameter. Type Cecid 1400.

This female was taken by Dr. W. G. Dietz, at Hazelton, Pa., June 21, 1909.

Porricondyla vernalis, new species.

Female.—Length 1.75 mm. Antennæ as long as the body, thickly haired, dark brown; 13 segments, the fifth with a stem $\frac{1}{4}$ the length of the cylindric basal enlargement, which latter has a length thrice its diameter and a rather sparse subapical whorl of long setæ; terminal segment somewhat reduced. Palpi: first segment subquadrate, the second with a length $\frac{1}{2}$ greater than the first, the third $\frac{1}{3}$ longer than the second, more slender, the fourth $\frac{1}{2}$ longer than the third. Mesonotum reddish brown. Scutellum yellowish, postscutellum reddish yellow. Abdomen sparsely haired, fuscous yellowish. Halteres yellowish transparent. Coxæ reddish yellow; femora, tibiae and tarsi fuscous straw, except for the whitish distal three segments, especially marked on the posterior legs; claws stout, strongly curved, unidentate, the pulvilli shorter

that the claws. Ovipositor short, the lobes biarticulate, the terminal segment broadly oval, with a length about twice its width. Type Cecid 1401.

This species was taken May 16, 1910, by Dr. W. G. Dietz, at Hazelton, Pa. It is allied to *P. tuckeri* Felt, from which it is easily separated by the stouter antennal segments and the broader lobes of the ovipositor.

Porricondyla dietzii, new species.

Female.—Length 1.5 mm. Antennæ $\frac{1}{4}$ longer than the body, sparsely haired, dark brown; 12 segments, the fifth with a stem $\frac{1}{3}$ the length of the cylindric basal enlargement, which latter has a length about four times its diameter; terminal segment with a length not over five times its diameter. Palpi; first segment slender, with a length five times its diameter, the second a little shorter, stouter, the third a little longer than the second and the fourth $\frac{1}{3}$ longer than the third. Mesonotum shining black. Scutellum and postscutellum fuscous yellowish. Abdomen sparsely haired, a variable yellowish and brown. Wings long, narrow. Halteres yellowish. Coxæ and femora mostly pale yellowish, the remainder of the legs fuscous straw. Ovipositor short, the terminal lobe narrowly oval, with a length over twice its diameter, thickly setose. Type Cecid 1398.

This species was taken June 4, 1910, at Hazelton, Pa., by Dr. W. G. Dietz. It is closely allied to *P. porrecta* from which it is easily separated by the black mesonotum and the perceptibly shorter terminal segments of the antennæ and palpi.

Porricondyla porrecta, new species.

Female.—Length 1.3 mm. Antennæ a little shorter than the body, sparsely haired, fuscous yellowish; 12 segments, the fifth with a stem about $\frac{1}{3}$ the length of the cylindric basal enlargement, which latter has a length about four times its diameter; terminal segment greatly produced, with a length fully six times its diameter. Palpi; first segment slender, with a length five times its diameter, the second segment as long as the first, stouter, the third as long as the second, more slender, the fourth $\frac{1}{2}$ longer than the third, very slender. Face fuscous yellowish, mouth reddish. Mesonotum dark brown, the submedian lines narrow, yellowish. Scutellum pale red, postscutellum fuscous yellowish. Abdomen yellowish brown, the dorsal sclerites fuscous brown; ovipositor pale yellow. Wings hyaline, costa dark brown. Halteres yellowish basally, fuscous subapically. Legs fuscous yellowish with the distal segment of the posterior tarsi lighter; claws stout, strongly curved, unidentate, the pulvilli as long as the claws. Ovipositor short, terminal lobe narrowly oval and sparsely clothed with long setae. Type Cecid a1628.

This female was taken on the window of a forest hut at Davidson's River, N. C., September 26, 1906. It is closely allied to *P.*

quercina Felt and may be distinguished by the yellowish brown abdomen, the longer, more slender palpi and the form of the terminal lobe of the ovipositor.

Dasyneura eugeniae, new species.

Gall.—Light green, irregularly subglobular and with a diameter ranging from 5 to 7 mm. Each gall contains a number of oval cells approximately 1.5 mm. in diameter. One examined March 22 contained a living pupa.

Male.—Length 1.5 mm. Antennæ longer than the body, sparsely haired, brownish black; 20 segments, the fifth with a stem as long as the cylindric basal enlargement, which latter has a length $\frac{1}{4}$ greater than its diameter and a thick whorl of very long, slender setæ; terminal segment reduced, narrowly oval, and sometimes fused with the preceding. Palpi; first segment subquadrate, the second with a length four times its diameter, the third a little shorter, more slender, the fourth $\frac{1}{2}$ longer than the third. Mesonotum reddish brown. Scutellum yellowish, postscutellum yellowish brown. Abdomen yellowish. Genitalia fuscous. Wings hyaline, the third vein curving anteriorly. Halteres yellowish. Coxæ, femora and tibiae mostly pale straw, the tarsi dark straw or brownish; claws rather heavy, unidentate, the pulvilli as long as the claws. Genitalia, dorsal plate deeply and triangularly emarginate; ventral plate deeply and roundly emarginate, the lobes slender. Harpes stout, with a quadrate process near the internal distal angle; style short.

Female.—Length 1.75 mm. Antennæ nearly as long as the body, sparsely haired, dark brown; probably 20 segments, the fifth sub sessile, with a length about twice its diameter and rather thick subbasal and subapical whorls of long, stout setæ. Ovipositor about $\frac{2}{3}$ the length of the abdomen, moderately stout, the terminal lobes narrowly lanceolate, with a length thrice the width. Other characters practically as in the male. Type Cecid a2258.

This midge was reared from the deformed fruit of *Eugenia buriifolia* collected at Key West, Fla., March 15, 1912, by E. A. Schwarz. The adults are easily separated from their allies by the numerous antennal segments.

Youngomyia pennsylvanica, new species.

Male.—Length 2.25 mm. Antennæ $\frac{1}{4}$ longer than the body, thickly haired, dark brown; 14 segments, the fifth trinodose, the basal and distal stems with a length $\frac{3}{2}$ and twice their diameters, respectively; the middle constriction deep; circumfili stout, the loops short, not extending to the tip of the segment; terminal segment, basal portion of the stem with a length $2\frac{1}{2}$ times its diameter, the middle and distal enlargements narrowly united, the latter subcylindric, with a length nearly twice its diameter and apically a long, somewhat fusiform appendage. Palpi; first segment short, irregularly subquadrate, the second and fourth equal, the third a little shorter. Mesonotum dark brown, the submedian lines, scutellum and postscutellum fuscous yellowish. Abdomen sparsely haired, darker. Costa dark brown. Halteres yel-

lowish. Coxæ and femora yellowish, the remainder of the legs fuscous yellowish. Genitalia: basal clasp segment with a long, thickly setose, narrowly triangular lobe at the internal basal angle; dorsal plate short, narrowly and slightly incised, the lobes produced laterally, mainly oblique and thickly setose; ventral plate long, broadly rounded; style long, expanded distally, broadly emarginate. Type Cecid 1395.

This interesting male was taken at Hazelton, Pa., June 12, 1910, by Dr. W. G. Dietz. This species is easily separated from previously characterized males by the extremely short basal portion of the stem of the fifth antennal segment.



FOUNDATION OF SOME NEW GENERA AND SPECIES OF MUSCOID FLIES MAINLY ON REPRODUCTIVE AND EARLY-STAGE CHARACTERS.

BY CHARLES H. T. TOWNSEND,

PIURA, PERU.

The adult specimens which serve as partial types of the following forms I have been unable to secure for description of their external characters. They were left by me in 1909 partly in the U. S. N. M. collection, and partly in the collection at the Gipsy Moth Parasite Laboratory, and all were properly labeled with TD numbers. It has been impossible as yet to locate them or have them sent to Peru, and therefore their full description must be deferred until some future time. Meanwhile the names are needed for use in the paper on the reproductive systems, eggs and first-stage maggots, to be published with figures under the title of "Contribution to a Thorough Knowledge of the Muscoid Flies." Therefore I propose here formally to found these several genera and species on descriptions as complete as it is possible for me to make them at this time, necessarily drawn mainly from the reproductive, egg and first-stage maggot structures. I believe that the forms can be unmistakably determined in each case from the characters and data given.

Plagiops littoralis, new species.

Plagiops sp. nov., TD 38—Ann. E. S. Am., Vol. IV pp. 131 and 141.

Numerous specimens were taken at Ocean Beach, across Biscayne Bay from Miami, Florida, Nov. 9 to 22, 1908, on the flowers and foliage of the dwarfed *Ernodea littoralis* growing in sand near the beach. The genus has been described, with the Peruvian species *meridionalis* as type. The external adult characters of the present species will be given later. This genus is the first and only form with a *Voria*-like venation to show a flattened macrotype egg, which is evidently deposited on the host. The egg is pearly-white, flattened-subovate, and of much smaller size than the ordinary flattened macrotype eggs. The chorion is neither reticulate nor furnished with operculum. A marked peculiarity of this genus is noted in the description of the reproductive system of *P. meridionalis* in Contr. Th. Knowl. Musc. Flies. The uterovagina is of ordinary size but more or less chitinized so as to exhibit much the appearance of a swollen spermatheca. It is furthermore normally telescoped within the base or proximal end of the very long tubular and chitinous ovipositor, and the ducts of the spermathecae and tubular glands are very elongate to allow of this position of the uterovagina, since both the spermathecae and the tubular glands themselves remain outside.

The fly looks like a very small *Voria*.

Type, TD738 (fly, slide of uterovagina and eggs).

Described from TD736, 737, 738, 749, 921, 932, 1085, 1087, 1088, etc.

Phasiopsis floridana, new genus and new species.

TD651—Ann. E. S. Am., Vol. IV, p. 131.

Numerous specimens taken by Mrs. Townsend and myself at Miami, Fla., Nov. 4 to 29, 1908. Most of the specimens were collected on herbage and flowers along the Biscayne Bay front, but the species was also taken on flowers of *Euthamia* some miles north of Miami. Seems to be intermediate between the Ectophasiinae and Exoristini. The fly possesses well-developed macrochæte and is probably to be classed with the Exoristini, but its habitus suggests Phasiid affinities and its egg-characters strongly approach those of *Trichopoda* and other Ectophasiinae. Its external adult characters will be pointed out later. The eggs are flattened macrotype, but of much less than the ordinary size. They are light to dark brown in color while still in the ovarioles, and occur in two small clusters marking the ovaries and

massed against the posterior ventral plates. A dozen or so of these eggs occur in each ovary, indicating as many ovarioles, the ova developing successively. In one or two cases several eggs were found in the uterus or uterovagina next ovipositor. The dissections did not establish the presence or absence of incubating uterus, but such is probably not present. The Phasiid resemblances lie partly in the brownish color of the mature egg in the ovarioles, which is commonly seen in the Trichopodine flies. With the present exception no Exoristine flies are yet known with other than white or pearly-whitish eggs in the ovarioles, except possibly *Cyclotophrys anser* which deposits golden eggs. The egg is proportionately more elongate than that of *Exorista* and its allies, and may be described as narrowed elongate-subovate to subelliptical, but the mature chorion appears evenly bulged arc-like on the left side and more or less nearly straight on right side. This does not seem due to position of egg in the mount, the eggs all seeming to lie flat on their ventral surface. The micro-pyle and anal alveolæ are out of center in these eggs, indicating as do the preceding characters that the convex surface is laterodorsal. The chorion is without either operculum or reticulation. The egg is shown in Fig. 29 of Contr. Th. Knowl. Musc. Flies.

The fly resembles in size and general appearance a small specimen of *Chatolyga militaris* Walsh (commonly determined by Coquillett as *Winthemia quadripustulata*), but the latter has much broader and uncolored eggs.

Type, TD663 (fly, two slides of eggs).

Described from TD651, 663, 906, 1102, 1103, 1130, 1131, 1175, 1201, etc.

The present species is the type of the genus and also of the tribe Phasiopsini.

Neothelaira dexina, new genus and new species.

One female taken by Mr. F. B. Lowe near Swampscott, Mass., Aug. 29, 1908. This fly has a Pseudodexiine habitus, but apparently is to be classed in the Exoristinæ. Arista short and stout, third antennal joint long and slender, face oblique, head golden pollinose; abdomen elongate with long erect marginal and shorter discal bristles. Facialia quite bare; apical scutellar bristles weak and decussate, erect; next scutellar pair very long. Facial plate showing a slightly

prominent oral margin, the vibrissæ inserted a little above same. There appeared to be no uterus, and about thirty eggs were found in the ovarioles. The egg is flattened-subovate macrotype, whitish, probably without either reticulation or operculum.

Type, TD427 (fly and slide of eggs).

This is type of the genus and also of the group-unit *Neothelairina*.

Spathidexia clemonsi, new genus and new species.

TD371—Ann. E. S. Am., Vol. IV, p. 140.

One female, Melrose Highlands, Mass., Aug. 17, 1908, collected by Mr. D. H. Clemons, for whom it is named. This specimen has been determined by Mr. W. R. Thompson as *Thelairodes cinereicollis* V. d. W. It can not be that species, though it is probably the species so determined by Coquillett. So far as the description by B. & v. B. of *Thelairodes* goes, which is of the male only, it can not be positively referred to that genus. The female has a curved, blade-like larvipositor. The uterus contained about 110 eggs and maggots. The maggot is white, subcylindrical, quite elongate and only moderately stout, the cephalic end somewhat tapered, the anal end rounded and tipped with a circular patch of very small, short, stout spines. More or less complete circlets of smaller spines occur on the forward edge of each body segment except first and third, those of segments two and four being widened and band-like, those of five half as wide, the others still narrower. The cephalopharyngeal skeleton is stout but shortened, the upper wing of the pharyngeal sclerite being atrophied into a sharp curved spur, its lower wing and infrapharyngeal sclerite represented only by a small, short terminal spine, but the anterior or arm portion of the pharyngeal sclerite is widened. Hypostomal sclerite moderately short and stout, infrahypostomal curved-linear in profile. Mandibular sclerite much widened and dilated, showing in profile a shortened-subovate outline.

Type, TD371 (fly and slide of eggs and maggots).

This is type of both genus and tribe Spathidexiini.

Oxynops serratus, new genus and new species.

One female of this form was taken by Mrs. Townsend on herbage along Biscayne Bay front at Miami, Fla., Nov. 30, 1908. It is a small blackish form of Compsilurine habitus, and my notes mention it as having a long tail-like larvipositor and perhaps a piercing structure.

Its full characters will be given later. The uterus is very long and slender, filled with elongate white eggs and stout white maggots in single file. The maggot differs from the *Compsilurine* maggot in having six short double transverse ventral rows of microscopic faintly-colored platelets, minutely spined on their posterior and lateral edges, the spines all directed more or less posteriorly. There is also a transverse ventral bunched row of anal claw-like slender spines, besides the few usual stout dorsal anal stigmatal hooks or claws. The cephalopharyngeal skeleton differs from that of *Compsilurini* in the pharyngeal sclerites being less developed and not arcuate in profile, the hypostomal and mandibular regions more elongated, and the mandibular sclerite curved hook-like near tip. The egg, maggot and cephalopharyngeal skeleton are shown in Figs. 68 to 72 of Contr. Th. Knowl. Mus. Flies.

Type, TD1282 (fly, three slides of eggs and maggots).

This is type of both genus and tribe *Oxynopini*.

Euzenilla aurea, new genus and new species.

Euzenilla aurea, gen. et sp. nov., TD1283.—Ann. E. S. Am., V. 1, 1912, p. 28.

One female, found Aug. 15, 1908, at Gipsy Moth Parasite Laboratory, Melrose Highlands, Mass., inside large out-door cage (shown in Figs. 25 and 26, Tech. Ser. Bull. 12, pt. VI), where it had probably issued either from the earth or from some host brought in from the outside. Evidently a North American species. The fly is small and has the entire head, thorax and scutellum deeply golden-pollinose, only the abdomen being obscure or cinereous. The uterus contained about 75 to 100 maggots. The maggot is white, moderately slender, thickly and evenly beset over whole body with short spines except only at junctures of segments and on posterior half of dorsum. The cephalopharyngeal skeleton is slightly suggestive of the Dexiid type, but the pharyngeal sclerite is slightly widened and distinctly curved in profile, thus not in line with hypostomal and therefore never forming with the hypostomal sclerite a straight rod-like structure. Moreover, the mandibular sclerite is stout claw-like apically, the claw being notched on its superior edge, thus approaching the Zygosturminini-type. It slightly approaches the Sardioceratine type in having a very short and rudimentary pair of anal processes carrying the tracheæ. The maggot is shown in Fig. 76 of Contr. Th. Knowl. Musc. Flies.

Type, TD350 (fly and slide of eggs and maggots).

This species is type of both genus and tribe Enzenilliini.

Epidexia filamentosa, new genus and new species.

TD747—Ann. E. S. Am., Vol. IV, p. 146.

Various specimens taken on flowers and leaves of the dwarf *Ernodea littoralis* at Ocean Beach, across Biscayne Bay from Miami, Fla., Nov. 9 to 15, 1908. This is a small form, obscurely colored but with yellowish legs, of Pseudodexiine habitus and facialia ciliate; its full external adult characters will be given later. The eggs are microtype, flattened-subovate, black, chorion smooth and without either punctulation or reticulation. In all the balsam mounts of the eggs translucent filament-like and loop-like pendants are seen attached to the ventral surface. These are probably very delicate membranous appendages of the chorion whose function is to attach the egg more firmly to the leaf-surface. The uterus is very long and slender, and has a capacity of several thousands. The egg and chorion are shown in Figs. 126 to 130 of Contr. Th. Knowl. Muse. Flies.

Type, TD747 (fly, slides of eggs and dissection of uterus).

Described from TD747, '915, etc.

This species is type of the genus and also of the tribe Epidexiini.

Euceromasia spinosa, new genus and new species.

TD390—Ann. E. S. Am., Vol. IV, p. 146.

One female, North Andover, Mass., August 21, 1908, collected by Mr. D. H. Clemons. This small fly has been determined by Mr. W. R. Thompson as *Masicera* near *pauciscta*. It has discal and marginal abdominal bristles, and *Eusisyropa*-like abdomen and venation. The uterus was extremely long and coiled, and contained a thousand or more microtype eggs. The egg is flattened and perfectly ovate, like a miniature egg of *Exorista* but golden or yellow in color. The yellow chorion appears thick, is reticulate in nearly perfect hexagons, and the periphery is sparsely set with erect short spines or pointed elongations of the chitin which appear in profile under a high power like sharp protruding spikes driven through the chorion from below. This type of chorion is wholly distinct from any other so far known in the Masiceratidae or elsewhere in the Muscoidea. The structure and spines of egg-chorion are shown in Figs. 147 and 148 of Contr. Th. Knowl. Muse. Flies.

Type, TD390 (fly and slide of eggs and maggots).

The type of tribe Euceromasiini as well as of genus.

Otomasicera patella, new genus and new species.

One female, Melrose Highlands, Mass., June 8, 1909, collected by Mr. W. R. Thompson. Uterus contained many black microtype eggs. The egg is limpet-like, being flattened on under surface and showing dorsally a short-subconic profile, the dorsal portion with subcontinuous irregular concentric veins or wrinkles apparently formed by thickenings of the chorion. The chorion between the concentric veins is net-like in structure in the peripheral region but denser and with fewer punctures in the central region. There is no honeycomb reticulation. The egg, chorion structure and cephalopharyngeal skeleton of first-stage maggots are shown in Figs. 168 to 171 of Contr. Th. Knowl. Muse. Flies.

Type, TD2714 (fly and 2 slides of eggs with a few partly developed maggots).

This is type of tribe Otomasiceratini as well as of genus.

Cnephalomya floridana, new genus and new species.

Cnephalomya floridana gen. et sp. nov., TD877—Ann. E. S. Am., Vol. IV, pp. 132 and 144-5.

Numerous specimens of both sexes taken on flowers of *Euthamia* a few miles north of Miami, Florida, and at White Springs, Fla., during October and November, 1908. Allied to *Cnephalodys* on reproductive and egg characters, and approaching *Cnephalia* in general habitus. The uterus is very long and tube-like, rather or quite slender, in very many coils, and contains up to some five thousand microtype eggs. Differs at once from *Cnephalia* not only in certain external adult characters to be pointed out later, but also in the peculiar form of the eggs in utero. Both white or undeveloped and black or maturing eggs are elongate and appear with the low power of the binocular to be quite sharply pointed at each end but more tapered at cephalic end, reminding one of microscopic miniatures of certain grass-seeds. Many females were dissected, and in all of them without exception all the eggs, both white and black, were of this same form. In the entire lot of material, however, not one egg containing a fully-developed maggot could be found. The early embryos were numerous, but none showed even the beginnings of the cephalopharyngeal skele-

ton. The form of the maggot is unmistakably indicated in these early embryos, being elongate-subcylindrical and slightly tapered at cephalic end. Examination with high power shows the chorion, when flattened out, to be subovate, and the ends of the embryo of the egg-substance, enclosed in the vitelline membrane, to protrude obtusely at each end, thus giving the pointed effect to the egg as seen with the low power. The chorion is conspicuously honeycomb-reticulate in almost perfect hexagons, the whole evenly interspersed with fine punctulations. The eggs and chorion structure are shown in Figs. 181 to 186 of Contr. Th. Knowl. Musc. Flies. The spermathecae are large, and the ovaries are composed of many ovarioles. The fly is slate-colored and pollinose, of practically the same size and general appearance as the North American species of *Cnephalia* and the European *Spallanzania hebes*.

Type, TD877 (fly, slides of eggs and dissection of uterus).

Described from TD492, 513, 576, 705, 706, 824, 877, 896, and others.

The present species is the type not only of this genus but of the subfamily Cnephalomyiinae.

***Phasiopteryx montana*, new species.**

Phasiopteryx sp. (Colorado), TD1791—Ann. E. S. Am., Vol. IV, pp. 136-7.

One female, labeled "Col." in U. S. N. M. collection. This fly does not differ in external characters from *Phasiopteryx bilimcki* B. B., of southern Mexico, so far as is yet known. The specimen was in fact determined by B. & v. B as that species. The uterus is very long and slender, irregularly coiled. In the dried specimen the coils of the uterus adhered to the inside of the dorsal abdominal walls, and the dark smoky-brown maggots were seen through the light yellow of the tergites like dark specks in the body wall. The maggot is isopodiform, flat and broad-elongate when extended, showing lateral emarginations due to the lateral segmental plates, in general outline elongate-ovate to ovate, more pointed anteriorly, strongly suggesting an isopod without appendages. Color pale reddish-brown to chestnut-brown. There are thirteen recognizable segments, of which the second apparently corresponds to segment II of Hewitt, for it is not likely from the position of the cephalopharyngeal skeleton that it represents his segments II and III of *Musca*. The thirteenth segment is probably double and represents the last two primitive body segments.

For convenience of description the segments will be referred to as the first to thirteenth, which are the apparent segments. First segment (pseudocephalon) small and tubercular, often retracted; segments three to twelve are chitinized on sides and dorsum. Segments five to eleven are composed apparently of six sclerites, or plates each; one dorsal, one ventral, and two lateral on each side. Segment four is probably composed thus, but does not show the plates so clearly. The posterior margins of dorsal plates of segments three to eleven overlap the anterior margins of the succeeding dorsal plates in each case. The ventral plates are whitish and membranous. The dorsal plates are deeply tinged and chitinized, the dorsolateral more deeply chitinized, and the ventrolateral hardly less so. Dorsal plates three to eleven show in hind margin eight small round holes or light unchitinized spots, which are probably the scars or origins of detached bristles, three being usually in a triangle on each side and one outside of them. The ventrolateral plates each bear one of these hole-like dots in hind margin. The ventral plates show none, but are covered with very minute, short, dot-like spines with a row of longer spines on front border. The dorsolateral plates each bear one of the hole-like dots. The lateral plates are so arranged as to show one lateral row of double leaf-like plates lying apparently free, the posterior edges of one set overlapping the bases of the next, as may be seen in the below-mentioned figure, extending thus the length of body on each side from segments four to eleven inclusive. Segment thirteen is terminated by four rather sharp tubercles in a horizontal row, each surmounted by a spine-like bristle, the outer one on each side being stronger than the two inner ones. The small lateral plates of segment twelve, which consist of only one on each side, taper posteriorly to a point and are surmounted by a bristle. Between these, but on the dorsum of thirteenth segment, are the two anal stigmatal plates, appearing as two small rounded tubercles, and just in front of each is a very small shortened tubercle surmounted by a very short seta. Each anal stigmatal plate bears four bristle-scars on its periphery, and outside the area of the stigmatal openings. The first two segments and anterior half of third are covered with the same minute dot-like spines as the ventral plates. The cephalopharyngeal skeleton occupies the first to fourth segments inclusive, and shows a strong approach to those of *Spathidexia* and *Ophirion*. The upper wing of pharyngeal

sclerite is strong, curved, spur-like, the lower wing strong, spine-like. The infrapharyngeal sclerite is present and distinct, the infrahypostomal likewise. The mandibular is enlarged and flattened long-ovate or subelliptical in profile, and the labial sclerite is apparently well developed. The maggot and cephalopharyngeal skeleton are shown in Figs. 224 to 226 of Contr. Th. Knowl. Musc. Flies.

Type, TD1791 (fly, and slides of maggots and larvipositor).

Phasiopteryx bilimeki B. B.

Phasiopteryx sp. (Veracruz), TD1791a—Ann. E. S. Am., Vol. IV, pp. 136-7.

One female specimen collected by Herbert Osborn at Orizaba, Veracruz, Jan. 9-16, 1892. This fly is probably *Phasiopteryx bilimeki* B. B., as the type of that species came from Orizaba. For purposes of comparison with preceding, and as a contribution to a better knowledge of these remarkable forms, I give the description of the first-stage maggots taken from this fly. On same general plan as the maggot of *Ph. montana*, and color practically same, but differing as follows: Spines of front borders of ventral plates stronger and in double rows. Minute spines broadly massed along median line of venter, the lateral portions of plates bare. Dorsal plates with minute hole-like dots in a marginal row, not showing any definite arrangement by triangles. The lateral plates do not seem to assume the double, free-lying, laminate arrangement natural to *Ph. montana*; and there are no sharp tubercles or bristles on thirteenth segment, but the very small shortened tubercles each with a very short seta are present just in front of the stigmatal plates. The stigmatal plates are the same, and with the same four peripheral holes in each, but the plates are situated almost terminally on the segment. The twelfth segment has no lateral pointed plates tipped with a bristle. Most extraordinary of all, there are two remarkable talon-clusters or groups of claw-structures just in front of anterior border of third segment, attached to extreme base of second segment and lying one group on each side of the pharyngeal skeleton. Each group consists of an average of seven black, chitinized, tooth-like spines, spurs or short rods, each bearing a strong cat-claw hook, disposed longitudinally side by side, the central one conspicuously larger, the others successively dwindling in size outwardly from the central one. The size of the strongly-hooked

claw is in each case proportional to the size of the rod which forms its base. The cephalopharyngeal skeleton is practically the same as in *Ph. montana*. The egg, maggot, cephalic talon-clusters and cephalopharyngeal skeleton are shown in Figs. 220 to 223 of Contr. Th. Knowl. Musc. Flies.

Eutheresia monohammi, new genus and new species.

Eutheresia gen. nov. for Coquillett's *Theresia analis*—Ann. E. S. Am., Vol. IV, p. 149.

This is *Theresia analis* Coqt., attested by labels on specimens in the U. S. N. M. collection, and so far as I can find a MSS. name. Thirteen specimens issued, May 12 to July 17, 1894, from a section of black spruce trunk filled with *Monohammus confusor* grubs. The spruce was killed in August, 1893. (No. 6240² Bur. Ent.) This form is allied to *Sardiocera valida* B. B. (det. *Theresia tandrec* by Coqt.), from which it differs in the longer antennæ and the narrowed instead of widened-ovate abdomen. The first-stage maggot is very similar to that of *Sardiocera valida*, but has the anal processes somewhat shorter, and the posterior edges of all the segments are thin and sharply defined in profile, while those of segments X to XII in *Sardiocera* are knot-like in profile. The integument of forward margin of segments shows a broad band of microscopic rugosities, most conspicuous and abruptly defined on twelfth segment. The eggs are very slender and pointed. Uterus is short and stout, with a capacity of several hundreds, not running so high as capacity of *Sardiocera*, which is upward of two thousand. The egg, maggot and cephalopharyngeal skeleton are shown in Figs. 231 to 233 of Contr. Th. Knowl. Musc. Flies, and the host-habits are outlined in that paper.

Type, TD1788 (fly, and slide of eggs and maggots). Georgia (C. V. R. Coll.).

Other specimens are TD1415, and the rest of the above series from *Monohammus*. It is probable also that TD1417, labeled "Par. on Cerambycid in chestnut; iss. May 1, '88," is this species.

Protodexia synthetica, new genus and new species.

TD354—Ann. E. S. Am., Vol. IV, pp. 139 and 151.

One female, collected by Mr. D. H. Clemons, Melrose Highlands, Mass., August 14, 1908. This is a small brassy-pollinose fly with a Sarcophagid habitus. It seems to belong in or near the Sarcophagineæ.

The uterus, whose form is unknown, contained about forty maggots. The first-stage maggot is moderately slender, gently tapered at each end, white, with narrow bands of faint spines at the junctures of the segments, the first two anterior bands, especially the first, being usually the broadest and most distinct. The cephalopharyngeal skeleton lacks the dorsopharyngeal sclerite; the pharyngeal sclerite is normally developed in its upper wing, but the lower wing is atrophied and its place is taken by the infrapharyngeal sclerite. The hypostomal and infrahypostomal sclerites are distinct and both paired. The mandibular sclerite is paired and consists of a small but swollen base, passing into a slender and short median arm, and terminated apically by an elongate-subovate leaf-like or spatulate enlargement, while the dentate sclerite is elongate with a tooth at its apical angle. The skeleton is fuscous clear to the mandibular leaves, which are more approximated to each other than are the two sclerites forming any of the other pairs. The labial sclerites are only faintly distinguishable. There is no sign of the T-ribs of the pharyngeal floor described and figured by Hewitt. What is more, I have never been able to find any trace of these T-ribs in any first-stage muscoid maggot, and am constrained to believe that they do not occur in this stage. Hewitt's figure of them (Pl. 31, Fig. 18) is from the third stage of *Musca*. The anal stigmatal cavity that characterizes most sacrophagid maggots in all stages does not show. The anal stigmatic tubes are borne ventrally near base of thirteenth segment in a pair of short processes surmounted by two slightly chitinous pointed spines. The maggot and cephalopharyngeal skeleton are shown in Figs. 247 and 248 of Contr. Th. Knowl. Musc. Flies.

Type, TD354 (fly and slide of maggots).

This is type not only of the genus but of the tribe Protodexiini.

In explanation of my later but still tentative interpretation of the segmental homologies in the muscoid maggot, I should state that the dentate is apparently not an ordinary or main sclerite as published by me in Ann. E. S. Am., Vol. IV, pp. 150-1. Leaving out the dentate, which is evidently a development from the mandibular sclerite, the other six form the ordinary sclerites as distinguished from the minor or subordinate sclerites. The six ordinary sclerites plus the pseudocephalon (segment I) and its paired labial sclerite would represent the seven primitive head-segments, or segments I to VII of ancestral

insects. Segments II to IV of the maggot (Hewitt) would represent the three thoracic segments, or segments VIII to X of ancestral insects; and segments V to XIII of the maggot (Hewitt) would represent the ten primitive abdominal segments, or segments XI to XX of ancestral insects, the anal or thirteenth maggot-segment being almost certainly double and representing the last two primitive body-segments. This interpretation is set forth in detail in Contr. Th. Knowl. Muse. Flies, with tentative homologies of the ordinary cephalopharyngeal sclerites.

The fact that thirteen distinct segments can be distinguished in the first-stage maggot of *Phasipteryx*, of which the cephalopharyngeal skeleton occupies the first four, implies that here segments II and III of Hewitt are not coalesced as in *Musca* and most other types.



INSECTS ON A RECENTLY FELLED TREE.

BY WILLIAM T. DAVIS AND C. W. LENG,

NEW BRIGHTON, N. Y.

On November 14, 1911, we found at Cleveland, near Punta Gorda, Florida, a large pine tree cut down and lying nearly horizontal, supported only by such of its branches as had not been broken or hacked off. The tree was a long leaf pine (*Pinus palustris*) and, as we subsequently learned, it had been felled a week previous to our finding it. We beat the branches and the trunk over our umbrellas, scraped the bark off in places, pounded the piles of cut branches, lifting each free from the pile for the purpose, and obtained many insects, principally Coleoptera, in that way, or as they ran away over the ground on being disturbed by us; others were found in the chips about the stump of the tree. The larger and more brilliant species, *Acanthocinus*, *Monohammus*, *Temnochila*, *Chrysobothris*, etc., were easily seen on the trunk and branches, the smaller species were dislodged by our beating sticks, until, after two hours work, a total of 42 species of Coleoptera and 13 species of insects of other orders had been bottled. Over 300 specimens of Coleoptera alone were taken and as many specimens of the more abundant species were allowed to

escape, it may be possible that a thousand insects were at work on the dead pine the morning we were there.

In conjunction with these facts the further fact must be taken into consideration that for two weeks we had been beating branches, living and dead, of the same species of tree at various places in Florida with the usual mixture of success and failure, sometimes no result, sometimes three or four specimens, never any large number, to appreciate this illustration of the value to the beetle collector of a recently felled tree. The practice of cutting down trees of various species, of partly cutting through branches so that they will hang with their withered leaves conveniently for beating, is not new; but it may be worth while to add a list of the insects we caught in two hours on one tree to emphasize the advantage of this method of collecting.

LIST OF SPECIES.

Coleoptera.

- Tachys scitulus*, a single specimen.
Selenophorus iripennis,¹ on the ground.
Scymnus myrmidon,¹ on the pine needles.
Scymnus sp., on the pine needles.
Silvanus bidentatus, plentiful.
Silvanus imbellis, under the bark.
Silvanus sp., a single specimen.
Nausibius repandus,² two specimens.
Cicones lineaticollis,¹ a single specimen.
Lasconotus referendarius, plentiful.
Lasconotus pusillus,¹ a single specimen.
Aulonium ferrugineum, several.
Psammoecus desjardinsi,¹ a single specimen.
Hister attenuatus, plentiful.
Hister parallelus, plentiful.
Hister cylindricus, a single specimen.
Nemosoma cylindricum, several.
Trogosita virescens, very abundant.
Tenebrioides collaris, several.
Dicrepidius ramicornis,¹ a single specimen.
Monocrepidius auritus,¹ a single specimen.
Monocrepidius bellus, several.
Chalcophora virginiana,¹ a single specimen.
Chrysobo hris floricola, abundant on branches.
Chrysobothris dentipes, abundant on branches.

Ernobius granulatus, several.
Catorama sp.,² a single specimen.
Criocephalus nubilus,¹ a single specimen.
Nylotrechus sagittatus, several.
Monohammus tittillator, several.
Leptostylus arcuatus,¹ a single specimen.
Acanthocinus oboletus, several.
Acanthocinus nodosus,¹ a single specimen.
Platydema flavipes, several.
Hypocephalus glaber, abundant.
Hypocephalus thoracicus,¹ a single specimen.
Helops cis eloides,² several.
Hylobius pales, plentiful.
Tanymecus lacæna,¹ a single specimen.
Conotrachelus anaglypticus, a single specimen.
Ips (Tomicus) avulsus,² several.
Pityophthorus concentralis, two.

Orthoptera.

Eurycotis floridana Walker,¹ a single specimen of this roach was found among the chips at base of stump.
Ischnoptera sp. (young),¹ two specimens at base of stump among chips.
Ceratinoptera lutea S. & Z.,¹ one specimen beaten from branch.
Mogoplistes sp.,¹ one of these small crickets was beaten from a branch; immature.
Orocharis gryllodes Pall.,¹ ditto.
Gryllus abbreviatus rubens Scudder,¹ among chips at base of stump.

Other Orders.

Two species of Hemiptera, *Cnemodus mavortius* Say and *Piezostethus sordidus* Reut, identified by Mr. H. G. Barber, two kinds of ants, *Solenopsis geminata* Fab. and *Camponotus fallax* var. *nearcticus* Emery, identified by Professor Wheeler, a scorpion and a pseudo-scorpion were also obtained.

¹ Taken by Mr. Davis only; he worked at the base of the tree, where more of the larger species were found, and at the piles of cut branches, which sheltered some species not found on the tree itself, as well as nearly all the insects other than Coleoptera. The smaller Colydiides and Scolytids were found hidden in the crevices of and between the layers of the bark.

² Identified by Mr. E. A. Schwarz.

THREE NEW SPECIES OF BELOCEPHALUS FROM FLORIDA.

BY WM. T. DAVIS,

NEW BRIGHTON, STATEN ISLAND, N. Y.

While at Punta Gorda in Southern Florida in November, 1911, with Mr. Charles W. Leng and Dr. Lutz, of the American Museum of Natural History, the writer was much interested in the songs of two species of *Belocephalus* that frequented the same clumps of palmetto. One of them was a large insect averaging 40 mm. in length and a bold singer. He would perch himself on the topmost leaf of a scrub palmetto and stridulate a song hardly to be distinguished from the rapid *ik-ik-ik* of the *Conocephalus ensiger* that inhabits north-eastern United States. The other was a smaller species averaging 31 mm. in length; was more retiring in habits, and sang a slow *zeek-zeek-zeek*. In addition to the size a difference in color was immediately noticed, namely the antennae of the larger species was always immaculate, while the smaller species had the first ten or fifteen joints spotted with black. These maculations in the brown individuals often became rings entirely encircling the first antennal joints, whereas in the large species, whether brown or green, the antennae were unicolorous. These two insects fed on the species of palmetto, their powerful jaws enabling them to gnaw the tough leaves.

On our way north to Jacksonville we stayed over a day at Newberry in the western part of Florida, and found under the loose bark of an old pine stump a *Belocephalus* that differed from the smaller species mentioned above mainly in the form of the fastigium, and in size. Mr. Leng found four others just like it between some boards piled by the side of the railroad.

In the Proceedings of the Boston Society of Natural History, Vol. XVII, 1875, Scudder described *Belocephalus subapterus* from two females, "one from N. E. Florida, the other from Florida." These types have been examined, but so far good characters have not been found for the separation of the females of all of the species of *Belocephalus*. This must await further collecting. A recent visit to Philadelphia and the examination of the material collected by Rehn &

Hebard in northeastern Florida, in Georgia and in South Carolina, proves that *Belocephalus* males coming from that section, and consequently to be considered as *B. subapterus* Scudder, are different from any of the three species mentioned above.

The three new species may be described as follows:

***Belocephalus sabalis*, new species.**

Type, green male from Punta Gorda, Desoto Co., Fla., Nov., 1911. Mandibles and lower edge of front black, the upper surface of the head and pronotum unicolorous, showing no stripes. Fastigium very sharp pointed, slightly bent downward and tipped with black. Inferior basal tooth of fastigium also tipped with black. Antennæ about as long as the body and unicolorous. Tegmina about two thirds as long as pronotum. Abdomen with a scarcely perceptible, interrupted carina. Legs unicolorous, except the tips of the spines which are black. The subgenital plate has two stout appendages with rounded extremities. They are about twice as long as broad. The outer extremities of the plate are not bent upward and inward and produced into points.

Length of body 41 mm.; of fastigium beyond base of antennæ 4 mm.; of pronotum 10 mm.; of tegmina 7 mm.; of hind femora 20 mm.

In addition to the type, twelve green males and one brown male, all from Punta Gorda, Fla., have been examined. The brown specimen differs in having a mid-dorsal stripe of a darker color. The stripe commences on the fastigium, widens posteriorly and extends to the base of the pronotum.

***Belocephalus hebardii*, new species.**

Types, brown male and green female, Punta Gorda, Desoto Co., Fla., Nov., 1911. Mandibles, lower edge of front and base of antennæ beneath black. The upper surface of the head and pronotum with a faint line on either side of a yellowish color, which is bordered interiorly with blackish. These stripes extend from the fastigium backward to the base of the thorax. Fastigium very sharp pointed, slightly bent downward and tipped with black. Inferior basal tooth of fastigium also tipped with black. Antennæ longer than the body and the first few joints blotched, or nearly encircled with black, the color fading out and the last joints unicolorous. Abdomen with a scarcely perceptible, interrupted, carina. Legs with a row of about eight fuscous spots on outer side of each fore femur, and the tarsi of all of the legs blotched, but irregularly, with fuscous. The female has some additional spots on the middle and hind femora. The subgenital plate of the male has two tapering appendages that are about three times as long as broad. The outer extremities of the plate are bent upward and inward, and produced into points.

	σ Mm.	♀ Mm.
Length of body	34	35
Length of fastigium beyond base of antennæ.....	2	3
Length of pronotum	9	9
Length of tegmen	8	3
Length of caudal femur	17	19
Length of ovipositor		21

In addition to the types five green males, six brown males and two brown females have been examined from Punta Gorda.

***Belocephalus rehni*, new species.**

Types, green male and brown female, Newberry, Alachua Co., Fla., Nov., 1911. Mandibles, lower edge of front and base of antennæ beneath, black. The upper surface of the head and pronotum with a faint line on either side of a yellowish color, which is bordered interiorly with blackish. These stripes extend from the fastigium backward to the base of the thorax. Fastigium short, blunt pointed and tipped with black. Inferior basal tooth of fastigium also tipped with black. Antennæ longer than the body and the first joints annulated with black, the color fading out toward the tip. Abdomen with a scarcely perceptible, interrupted carina. The femora and tibiae of all of the legs are blotched with brown, and the abdomen is finely flecked with the same color. The subgenital plate of the male has two tapering appendages that are about four times as long as broad. The outer extremities of the plate are not bent upward and inward into points.

	σ Mm.	♀ Mm.
Length of body	24	29
Length of fastigium beyond base of antennæ....	1.5	2
Length of pronotum	7	7
Length of tegmen	7	2
Length of caudal femur	13	17
Length of ovipositor		21

In addition to the types, three brown individuals, two males and a female, have been examined, all from Newberry, Fla.

The species of *Belocephalus* may be separated as follows:

Vertex of the head produced as a stout sub-cylindrical thorn tapering apically.

Body of ♂ about 40 mm. in length; antennæ unicolorus. The outer extremities of the subgenital plate not bent upward and inward, and not produced into points *sabalis* sp. nov.

Body of ♂ about 35 mm. in length; pronotum striped; antennæ spotted. The outer extremities of the subgenital plate as in *sabalis*.

subapterus Scud.

- Body of ♂ about 31 mm. in length; antennae spotted. The outer extremities of the subgenital plate bent upward and inward and produced into sharp points *herbardi* sp. nov.
Vertex of the head rounded, no thorn.
Body of ♂ about 25 mm. in length; antennae spotted. *rchni* sp. nov.

THE NUMBER OF MOULTS OF THE PEAR-SLUG, CALIROA CERASI LINNÉ.

BY R. L. WEBSTER,

AMES, IOWA.

In the course of some experiments with the pear-slug, *Caliroa cerasi* Linné, in the insectary of the Iowa Agricultural Experiment Station at Ames, considerable interesting data on the moults was obtained. A brief account of this work in general has already been given by the writer (1911). It seems well, however, to give the whole in detail here, as a study of the moults and head widths of this particular insect. The notes were made during the summers of 1909 and 1910; in 1909 by the writer, in 1910 by Mr. T. M. McCall and the writer.

A short account of the life history of this insect follows.

The larva is a dark, almost black, slimy slug, about $\frac{2}{3}$ of an inch long when full grown, which feeds on cherry, pear and plum leaves. These slugs feed on the upper side of the leaves, eating out all the tissue except the veins and the lower surface. The injured leaves become dry and brown and fall from the trees, which are sometimes left entirely bare of foliage in midsummer. The slugs appear twice during the year in central Iowa, the first brood coming on about the middle of June, the second about the third week in July. The insect winters in the larval stage in the ground.

Harris (1841) said that the larvae moulted five times, Dyar (1895) said that there were six stages (five moults to maturity), and also gave some measurements of the head widths. Marlatt (1897) in his account of the insect said that there were five moults. So there has been no difference of opinion regarding this essential point. However, the measurements which follow will show that considerable

variation may occur, at least under ordinary insectary conditions, although five moults (six stages) is no doubt normal.

Single larvæ were isolated in glass battery jars in the insectary and fed on cherry leaves. A small cherry twig was placed in a bottle of water in each jar. Since there was no danger of the slugs escaping from the jars, these were usually left open at the top, although sometimes covered with netting. Observations were made daily on these cages, all moults recorded, and the cast head measured in every case. In moulting this species leaves the head intact, not splitting it down the middle, as do some saw-fly larvæ. It is the habit of the larvæ to eat their cast skins, although the head itself is not eaten, but remains on the leaf. By cutting out a small piece of leaf together with the cast head, this could be placed on a microscope stage and the head easily measured. The measurements were made with an ocular micrometer, used with a Leitz compound microscope, No. 3 objective, No. 2 ocular.

In the accompanying table of head widths of individual larvæ all the available data were used, whether or not a larva became full grown. Consequently a part of the records are incomplete, but all the figures given here were used in computing the average head width for the several stages. Each vertical column in the table represents a single larva, and each figure a separate and distinct moult.

It will be noticed that where complete records are given, larvæ moulted from five to eight times. Of these, five larvæ moulted 5 times, five 6 times, three 7 times and 1 larva moulted 8 times.

Considering first those larvæ that moulted five times it may be noticed that with only two of these the head width increased regularly in anything like a geometrical proportion. These are the larvæ in cages 53/09 and 214/10. In general the head width of a larva increases at some definite geometrical ratio with each stage, a fact to which Dr. Dyar (1890) has already called attention. In the case of the pear-slug the ratio of increase is practically .35.

In the other three cases there has been a slip in the progression. In cage 70/09 stage IV seems to have been missed entirely, for the width .72 mm. is hardly enough to give it a place in that stage. In cage 421/10 stage IV is clearly missing, even though there are five moults. Here the larva moulted twice, and the cast head measured .65 mm. each time. When it next moulted the head was 1.08 mm.

wide, clearly belonging to stage V. Again in cage 193 to stage I moults twice with a bare increase in width, while there is no measurement which fits stage IV.

MEASUREMENTS OF HEAD WIDTHS, 1909-1910.

Exp.	51'09	52'09	53'09	56'09	61'09	70'09	72'09	75'09	77'09	102'10	103'10	104'10	109'10	214'10	229'10	
I		.36		.36	.36	.36	.32	.36	.36	.39	.36	.36	.32	.39	.32	
II	.54		.50	.54	.54				.50	.50	.54	.50	.47	.54	.43	
III		.68	.68	.68		.65			.61	.65	.72	.68		.65	.72	
IV	.79	.79	.79	.75					.79	.87			.90	.90		
V	.98	1.01	1.01	.98		.98				.94			1.01	1.08		
No. of moults		5			5					5		5	5	6		
Exp.	23'10	24'10	24'10	24'10	25'10	40'10	40'10	40'10	42'10	42'10	42'10	42'10	42'10	43'10	45'10	
I	.32	.32	.32	.32	.36	.32	.32	.32	.36	.32	.29	.32	.32	.32	.32	
II	.43	.43	.43		.50	.47			.50	.50	.58	.58	.47	.43	.54	
III	.61	.65	.72	.68	.65	.68		.65			.68	.65	.72	.61	.65	
IV	.87	.87	.90		.87	.83				.90		.83	.79		.90	
V	1.08	1.08	1.01		1.05	1.16	1.05	1.08			1.16	1.01		1.08	.98	
No. of moults	6	6	7		7	7		5			6	6		8		

Among those larvae that moulted six times similar irregularities may be noticed in nearly every stage. The increase is often very slight, too much so to be considered as a separate stage.

With the larvae that moulted seven times there are two cases where two successive moults fail to show any increase whatever. The other extra moults are close together.

In the case of the single larva that moulted eight times there was a very slight increase every time, no two measurements being exactly the same. But here also the figures fall rather well into the five stages, as they are given in the table.

The following table shows the variation under the several stages. The figures at the right of each measurement indicate the number of times that measurement occurred.

Stage I.		Stage II.		Stage III.		Stage IV.		Stage V.	
Mm.		Mm.		Mm.		Mm.		Mm.	
.29	1	.43	5	.61	3	.75	1	.94	1
.32	15	.47	4	.65	9	.79	5	.98	4
.36	13	.50	7	.68	7	.83	2	1.01	5
.39	6	.54	11	.72	6	.87	4	1.05	2
		.58	5			.90	6	1.08	6
								1.16	2

This represents a great variation. In fact every space on the ocular micrometer scale between .29 mm. and 1.16 mm. is shown in the table.

From the figures in the two tables there are two things which stand out clearly: the fact of the variation in the number of moults, and the fact that a larva may moult, and yet not increase in size, or with very little increase.

Considering first the matter of variation it may be shown that this may be reduced to some order. I have said that the ratio of increase of the head widths was practically .35. The average measurements, made as given in the large table, are here compared to the theoretical figures at that ratio.

	Average.	Theoretical.
Stage I35	.35
II51	.47
III67	.63
IV85	.85
V	1.04	1.14
VI	1.13	1.14

In giving the average for stage VI measurements not included in the table are used. The average was made from a separate set of larvae. Stages V and VI may be compared to one figure in the theoretical column, since in the ultimate stage of certain saw-fly larvae (in which the larvae do not feed) the head width is practically the same as in the stage preceding it. In using the term "ultimate" I am following Dyar (1896). In this ultimate stage the larva is orange in color, and clean and dry of all slime. These orange larvae enter the soil soon after moulting and are seldom seen.

Doctor Dyar (1895) has recorded some measurements for the head widths of the stages. These are: I, .25 (?) (not measured);

II, .35; III, .55; IV, .8; V, 1.1 and VI, 1.1 mm. Comparing these with the average measurements just given it is evident that Dyar missed one stage, stage III, while the figure suggested for stage I is much too low. The figures for stages II and III are equivalent to those for stages I and II in our averages. Stage III then is missing in Dyar's figures. The measurements given for stages IV, V and VI are approximately equivalent to our averages.

Taking up the matter of increase in size of the head widths, it is seen that such an increase is by no means constant. The old idea of the moult process as one merely to allow for the growth of the larva will certainly not hold here, for in many cases little or no growth is recorded after a moult. Dr. O. W. Oestland, of the University of Minnesota, suggested to me that the idea of moult as an excretory process would fit just such a case as this. Folsom (1906), and probably others also, have suggested an excretory function of the moult process.

An explanation of the large number of moults, based on the idea suggested in the preceding paragraph, may be found in the somewhat artificial conditions of the insectary cages. Inside the glass battery jars it frequently becomes very hot. The water in the glass bottles which held the cherry twigs probably caused a high humidity also. Such conditions are very different from those outside on a cherry tree, where abundant shade and air currents would keep the temperature and moisture at lower points. It seems quite likely that these artificial conditions had an ill effect on the larvae, and these, in the endeavor to throw off this effect, moulted more than the normal number of times.

Saunders (1870) found that slugs would moult easily when sand or ashes were thrown over them. He applied sand to some slugs several times, but instead of being harmed by it, they simply moulted, leaving the sand with the old cast skin. Apparently the application of the sand was conducive to the moult; Saunders said that it occurred several times.

While the growth of the larva is without doubt an important factor in the ecdysis of the pear-slug, it apparently is not the only factor concerned. The fact that there may be moult without perceptible growth indicates that other reasons have an important bearing in the explanation of moult. In fact, growth may not even be a primary factor in the true explanation of the moult process.

BIBLIOGRAPHY.

- HARRIS, T. W. (1841). Ins. Inj. Veg., p. 382.
SAUNDERS, WM. (1870). Can. Ent., Vol. II, p. 148.
HARRIS, T. W. (1890). (Flint edition.) Ins. Inj. Veg., p. 531.
DYAR, H. G. (1890). Psyche, Vol. V, p. 420.
DYAR, H. G. (1895). Can. Ent., Vol. XXVII, p. 195.
DYAR, H. G. (1896). Can. Ent., Vol. XXVIII, p. 237.
MARLATT, C. L. (1897). U. S. Dept. Agr. Div. Ent. Cir., 26, p. 5.
FOLSOM, J. W. (1906). Entomology, pp. 164-165.
WEBSTER, R. L. (1911). Ann. Ent. Soc. Amer., Vol. IV, p. 181.
-

NOTES ON A MISTLETOE ANT.

BY WILLIAM MORTON WHEELER,

BOSTON, MASS.

While collecting in Miller Canyon, in the Huachuca Mts., Arizona, during November, 1910, my attention was attracted by the very large and beautiful masses of mistletoe (*Phoradendron flavescens* var. *villosum*) growing on the live oaks (*Quercus emoryi*) which in that locality abound at altitudes of 5,000-6,000 feet. I noticed that many of the masses of mistletoe had wilted more or less and had turned yellow. On closer examination I found that their stems at the base, and in many cases for several inches from their point of attachment to the oak branches, had been hollowed out by a beetle larva and that the cavities thus formed were regularly tenanted by colonies of a small black ant (*Cremastogaster arizonensis* Wheeler). The worker of this ant was first described from Tucson, Arizona,¹ where I found it to be not uncommon on the trunks of cotton-woods and mesquites in the valley of the Santa Cruz River. In the Huachucas it was not only living in the hollow stems of every yellow mistletoe which I examined—and I broke open dozens of them from many different oaks—but the walls of the cavity were invariably covered with reddish Coccids, which the ants were busily attending. These Coccids, which Prof. T. D. A. Cockerell has kindly identified for me as

¹"The Ants of Texas, New Mexico and Arizona," Part I, Bull. Amer. Mus. Nat. Hist., XXIV, 1908, p. 482.

Pseudococcus phoradendri sp. nov., are in all probability one of the causes of the wilting and dying of the mistletoe.

On consulting the literature I find that a very keen observer, Mr. E. A. Schwarz, has anticipated some of the preceding observations in a short paper published several years ago.¹ Speaking of the mistletoe on the trees of Bear Canyon, near Ft. Lowell, at the foot of the Santa Catalina Mts., Arizona, he says: "The majority of the more accessible mistletoe bushes proved to be more or less infested by *Lecanium phoradendri* and, in many instances, plants had been killed by the prevalence of the scale. A search for Coccinellid enemies produced, after considerable exertion, only a few specimens of *Cephaloscyminus occidentalis* Horn. Occasionally mistletoe branches, either not or but feebly infested with scales, were observed to be dead or wilting and it was found were hollowed out for a distance greatly varying in length, according to the thickness of the twig. The author of these galleries proved to be a Curculionid larva of the genus *Otidocephalus*, the particular species being still undescribed. The beetle makes its exit through a round hole at the side of the twig, and the deserted gallery is then usually occupied by a colony of ants, *Cremastogaster* sp., which attend to and protect the *Lecanium* scales."

"The infested twig is not killed at once by the boring of the *Otidocephalus* larva, but remains green for one season or longer, but at any rate long enough to allow colonies of a Scolytid beetle to undergo one or two generations in the terminal portion of the twig. This Scolytid, one of the smallest of our fauna, is also undescribed, and belongs, as far as I can make out at present, in the neighborhood of *Stephanoderus*. It is an 'inside borer,' but no regularity whatever can be observed in the tiny galleries, nor could one find any trace of 'ambrosia.' The colonies are extremely populous, a single one containing between seventy and a hundred specimens, but the males appear to be just as rare as in *Xyleborus*."

Schwarz also mentions a Bostrychid larva (*Amphicerus* sp.) which bores in the mistletoe stems and a Lycaenid larva (*Thecla halesus*) which feeds on the leaves.

There can be little doubt that similar phenomena were observed both by Schwarz in the Santa Catalina Mts. and by myself in the

¹ "On the Insect Fauna of the Mistletoe," Proc. Ent. Soc. Wash., Vol. IV, 1901, pp. 392-394.

Huachucas, and that the *Cremastogaster* and beetle are specifically identical in the two localities. The scale *Lecanium phoradendri*, however, lives on the outer surface of the mistletoe and was not seen by me, whereas the scale I observed, *Pseudococcus phoradendri*, lives hidden away in the hollow bases of the stems.

Schwarz's observations and my own, which were made independently in different parts of Arizona, thus reveal the existence of a peculiar coenobiotic association, in which at least five or six different organisms regularly coöperate: a live oak, a mistletoe, a weevil larva, one or two scale insects and an ant. The mistletoe is a parasite on the oak, the weevil and the scales are parasites on the mistletoe and the ant is, in a sense, a parasite on the beetle-larva and the scales, since it owes its dwelling to the former and derives its food-supply from the latter. The Scolytid beetle and the Lycænid caterpillar observed by Schwarz may also belong in this association, since the former perhaps finds the proper conditions for its existence only in mistletoe branches that have been injured by the weevil larva, and the Lycænid caterpillar may court the attentions of the ants. Some resident entomologist in Arizona will probably find that the exhaustive study of the coenobiotic association here briefly outlined has not only a theoretical but also a practical interest, for the *Cremastogaster* is to be regarded as a useful forest insect, since it cultivates scales that are injurious to a serious plant parasite of the live oaks and other trees.

Each of the *Cremastogaster* nests, which I opened, contained a single queen and in one nest a male specimen was taken. As these phases have not been seen before I subjoin a description of them:

Cremastogaster arizonensis Wheeler.

Female (deälated).—Length 5.5–6 mm.

Head large, rectangular, as long as broad, with straight lateral and posterior margins. Mandibles with 5 subequal teeth. Anterior border of clypeus sinuately excised. Antennal scapes reaching nearly half way between the eyes and the posterior corners of the head. Terminal joint of the two-jointed funicular club scarcely twice as long as the basal joint. Thorax elliptical, flattened dorsally, narrower than the head; posterior border of scutellum overarching the metanotum. Epinotum abrupt, on each side with a small tooth, which is not longer than broad at the base. Petiole and postpetiole similar to those of the worker.

Smooth and shining; mandibles and front of head more opaque; the former, clypeus, front and cheeks longitudinally striated, the mandibles and

clypeus also punctate. Remainder of the body with small, scattered, piligerous punctures.

Hairs pale yellow, erect, varying in length, rather sparse, mostly confined to the dorsal surface of the body. Pubescence long, but very sparse, distinct on the head, gaster and legs.

Rich reddish brown; head and antennæ, especially the scapes, darker; legs paler and more yellowish.

Male.—Length 2 mm.

Head subcircular; eyes very large; cheeks very short, posterior margin rounded behind the eyes. Mandibles minute, edentate, pointed. Antennal scape scarcely longer than the globular first funicular joint, which is distinctly broader than the succeeding joints; joints 2-6 as broad as long, remaining joints longer than broad. Thorax as broad as the head, similar to that of the female, but its epinotum is unarmed. Petiole and postpetiole like those of the worker, but their nodes are more rounded.

Sculpture and pilosity as in the female but shorter and less distinct.

Body yellow; upper surface of thorax and gaster brownish; mouthparts and antennæ white; legs pale yellow. Wings whitish hyaline with colorless veins and stigma.

The following is Prof. Cockerell's description of the Coccid that lives in the abandoned *Obidoccephalus* burrows:

Pseudococcus phoradendri Cockerell, new species.

"Female.—About $2-2\frac{1}{3}$ mm. long, $1\frac{2}{3}-2$ mm. broad, plump, reddish, mealy, strongly segmented. The specimens were collected in alcohol, so the nature of the mealy secretion cannot be precisely described, but it appears to have been scanty. Body with scattered minute round glands and small hairs; bristles of anal ring and the very low caudal lobes short. Legs and antennæ a lively clear yellowish ferruginous. The following measurements of legs and antennæ are in microns (μ).

Middle leg: femur and trochanter, 300μ long (width of femur 80); tibia 135; tarsus (excluding claw) 88; tarsal digitules 38, rather stout, with very small knobs; claw digitules moderate; claw short, curved, with no inner tooth.

Labium elongate, two-jointed, 150μ broad at base, 338 long.

Antennæ 8-jointed, joints measuring (1) 58-60, (2) 63-68, (3) 55-58, (4) 35, (5) 50-55, (6) 50-53, (7) 50-55, (8) 93-108.

Hab. Miller Canyon, Huachuca Mts., Arizona, 5,500 ft., Nov. 1, 1910 (W. M. Wheeler). Found in hollow stems of *Phoradendron flavescens* var. *villosum* (Nuttall), attended by *Cremastogaster arizonensis* Wheeler.

This little species reminded me strongly of the South American *P. missionum* Chl., but although that has similar antennæ, its femora

are conspicuously stouter. The antennæ also recall those of *P. formicarii* Ehrhorn, but that species is more hairy, and differs in the size and proportions of the legs."

MISCELLANEOUS NOTES.

Soronia decumana Er. in Alabama.—Mr. H. P. Loding has found this Mexican species of the family Nitidulidae at Spring Hill, Ala., February 16, under bark of oak. It has previously been reported by Mr. Schaeffer as occurring near Brownsville, Texas (Science Bulletin, Mus. Brooklyn Inst. I, 15, p. 375, Apr., 1909).—C. W. LENG.

Distribution of Hemiptera.—Some interesting records of distribution of certain Hemiptera that have recently come to my attention are herewith reported. Mr. John D. Sherman while collecting near the Huron Mountain Club, Lake Superior, Michigan, in June, 1911, took two specimens of *Pyrrhotes hæmatoloma* H. S. The occurrence of this species so far north of its usual range, in the southern states, is worthy of note.

Mr. George P. Engelhardt, collecting along the beach at Rockaway, Long Island, found a single specimen of *Ceralcptus americanus* Stål. Mrs. Slosson has a single specimen taken at Lake Worth, Fla.

In my collection is a specimen of *Lygaeus albulus* Dist. which I took at Woods Hole, Mass., in August, 1898. The occurrence of this species in the east seems extremely rare. Having some doubt about the identity of this specimen I referred it to Mr. Van Duzee, who compared it with a specimen of *L. albulus* determined by Mr. Distant, and the determination was correct.

I have three specimens of *Phymata vicina* Handl. in my collection from New Jersey, one taken at Madison by Mr. Paulmeier and the other two by myself in Lakehurst in June. This species has hitherto not been known from so far north.

Metatropiphorus belfragei Rent. was described from Texas. Mr. Wm. T. Davis has taken a specimen of this at Cape May, N. J., in Aug., 1910, and another at Yaphank, Long Island, July 25, 1908. In July, 1910, I took a single specimen of this species near Saug-

ties, N. Y. Mr. Van Duzee has collected this species in Florida, but owing to an error, it was omitted from his list of Florida Hemiptera.—H. G. BARBER.

Habits of Cerceris fumipennis Say.—Specimens of this wasp were not uncommon at Yaphank, Long Island, N. Y., where on Aug. 5, 1911, several colonies of from six to twenty hills, each the home of a wasp, were found. The hills, averaging one inch in height and two and one half inches in diameter, much resembled conical ant hills with a large hole at the top and were made in an area of compact sand from eight inches to two feet apart. The holes, approximating three eighths inch in diameter, begin sometimes immediately at the apex of the hill, and sometimes a little below the apex with a funnel-shaped excavation leading to them. From the top they were found to go directly downward to a little below the level of the ground and then curve to one side. In depth they ranged from four and one half to six inches, and there was no widened cell at the terminus. At the bottom of some of the burrows paralyzed Buprestids were found, but no eggs of the wasps were in any instance attached to them. Occasionally also a wasp would be found in the burrow apparently doing nothing. This was in the early morning. Towards the middle of the day the wasps became active and, catching them as they came from their hunting expeditions, were usually found to be carrying a Buprestid. On one occasion also two of the beetles were found lying on the loose earth which composed the hill. The Buprestids collected in this way represented three species determined by Mr. Leng as follows: *Dicerca punctulata*, *Buprestis lincata*, and *Chrysobothris floricola*, the first being the most abundant.

Mr. Wm. T. Davis also met with a hill of what is undoubtedly this same species of wasp at Butterfly Bridge, near Cassville, N. J., Aug. 11, with two *Dicerca punctulata* lying on its side. The owner of the hill was not about, but a good photograph identifies the latter with those found at Yaphank.—JOHN A. GROSSBECK.

PROCEEDINGS OF THE NEW YORK ENTOMOLOGICAL SOCIETY.

MEETING OF FEBRUARY 7, 1911.

A regular meeting of the New York Entomological Society was held in the American Museum of Natural History, February 7, 1911, at 8.15 P. M., with President Leng in the chair and seventeen members present.

The minutes of the previous meeting were read and approved.

Mr. Schaeffer, the librarian, reported the receipt of the following publications:

Canadian Entomologist, Vol. XLIII, No. 1.

Zeitschrift fur Wissenschaft, Insektenbiologie, Vol. VI, Nos. 11, 12,

Coleopterorum Catalogus, Pts. 24, 25, 26.

Tijdschrift voor Entomologie, 1910, Nos. 3, 4.

Wiener Entomol. Zeitung, Vol. XXIX, Nos. 9, 10.

Bull. de la Societe Imperiale des Naturalistes de Moscow, Vol. XXIII.

Entomologisk Tidskrift, 1910, Nos. 1-4.

New South American Parasitic Hymenoptera. J. C. Crawford.

New Species of Reared Ichneumon-flies. H. L. Viereck.

On Some Hymenopterous Insects from the Island of Formosa. S. A. Rohwer.

The curator, Dr. Lutz, reported that the Seifert collection had been acquired and that the boxes were arranged temporarily in the curator's room until suitable cases could be secured.

Dr. Southwick commented on the local collection of plants which he was presenting to the society, and stated that genus covers like the one exhibited were being installed and that later the specimens would be placed in them. In the local flora within 50 miles of N. Y. City 154 orders, 800 genera, and some 2,300 species are represented. Originally it was planned to arrange the specimens according to the insects infesting them, but it had been decided to arrange the collection as a botanical one. Attached to the cover of each plant there will be a list of the insect species infesting that particular plant and each sheet will be numbered and indexed.

Mr. Leng announced that the members at work on the local collection of Coleoptera would study the Scarabaeidae for the next few weeks.

Dr. Osburn presented his own photograph for the Society's collection and urged the members to present theirs. He also exhibited a sample of a method of binding pamphlets.

Mr. Pollard, chairman of the dinner committee, announced that 30 acceptances had been received. It was moved and carried that \$2.20 be appropriated from the treasury to defray half of the expenses of printing and sending out the announcements of the dinner.

Mr. Schaeffer, for the publication committee, stated that the March number of the JOURNAL had been sent to the printer and that this would be the

first number to contain miscellaneous short notes. Only two such notes were to appear in this number and Mr. Barber urged the members to present others for future numbers. It was suggested that members not attending the meetings might furnish such notes and suggested that a statement of the fact that they were desired be inserted under this heading in the JOURNAL.

Mr. Schaeffer reported that Professor J. B. Smith was presenting a loose-leaf copy of the List of N. J. Insects so that the society might bind it as desired and requested suggestions as to binding. After some discussion it was moved and carried that a committee be appointed to arrange for the binding of the List in such a manner as it was thought desirable and to solicit members to take charge of the various orders and record new captures. The president appointed on this committee Messrs. Engelhardt, Schaeffer, Osburn, G. W. J. Angell and Southwick. An additional copy of the List was presented to the society by Mr. Dow.

Mr. Groth exhibited some separates of the late Dr. Otto Seifert's papers some of which had been published in connection with his collection. Mrs. Seifert had presented these as well as some of Dr. Seifert's unpublished manuscripts which the society might publish if it so desired.

Mr. Pollard exhibited a case of rare exotic Saturnians and made some interesting remarks concerning the various species represented. He stated that Africa did not contain as many species of this group as some other regions of the world, but that the species and varieties found there were very interesting.

Mr. Grossbeck exhibited a variety of *Utetheisa bella* L. in which the pink had been replaced by a bright yellow and said that the specimen had been captured in the field and picked out of 300 specimens which he had taken in an hour near Paterson, N. J. He had been attracted to that particular spot by the larvæ crawling along the railroad track. Following these to their origin he found that they came from a sand hole surrounded on the other three sides by the walls of the pit and that growing in the bottom of the pit was an abundance of *Crotalaria*, the food plant of the larva. The caterpillars which had stripped the plants were migrating in search of food, but were unable to cross the rails. Thousands of larvæ were seen to be thus migrating.

Mr. Engelhardt exhibited an albino variety of *Utetheisa bella* L., several specimens of which he had taken at Rockaway Beach. He spoke also of the variety from Cuba, with the fore wings bright red, and of *Utetheisa ornatrix* L. which had been observed to vary considerably in Porto Rico, and suggested that an investigation of these insects in Jamaica by Mr. Grossbeck on his anticipated trip to that island, would be of much interest.

Mr. Davis showed 2 specimens of *Cicindela limbalis* Klug taken in the Ramapo Mts. in May, and stated that this made 5 or 6 specimens which had been taken locally. Mr. Harris mentioned the fact that Mr. John Sherman had taken several specimens of *patruela* Dej. and *limbalis* Klug under stones on an elevation near the Hudson River, at Peekskill, N. Y.

Mr. Wheat stated that recently he had examined wood along the shore at

Rockaway Park, Jamaica Bay, N. Y., for *Teredo* specimens. In one stick which was washed ashore he found, on cutting it open, Dipterous pupa cases and flies in the *Teredo* burrows, from which the flies were unable to escape. The species was not determined but evidently the fly had laid eggs in the burrow so that the maggots might feed on the remains of the mollusk.

Mr. Barber reported the capture of two Hemiptera new to the New Jersey list—*Acantholoma denticulata* Stål by Dr. Lutz, at Schooleys Mts., near Hackettstown, N. J., and *Banasa sordida* Uhler by Mr. Davis in Cape May Co., N. J.

Society adjourned.

E. L. DICKERSON,
Secretary.

MEETING OF FEBRUARY 21, 1911.

A regular meeting of the New York Entomological Society was held at the American Museum of Natural History, February 21, 1911, at 8.15 P. M. with President Leng in the chair and twenty-three members present.

The minutes of the previous meeting were read and approved.

Mr. Schaeffer reported that the committee appointed to arrange for the binding of the List of Insects of New Jersey had decided to divide it into several volumes and that an introduction and index would be provided for each of the interleaved volumes by Professor J. B. Smith.

Mr. Schaeffer also stated that the Bureau of the International Catalogue of Scientific Literature had requested that the JOURNAL be sent to them regularly and he moved that such a copy be sent. Motion carried.

Under scientific discussion, Mr. Henry Bird gave an interesting account of "New York City's Newest Moth, *Papaipema moeseri* Bird." This recently described species was found in the Adirondack region and western New York and also breeding in a glade on Staten Island. The first imago was obtained by a Buffalo, N. Y., collector. The larva was found breeding in a food plant near that of *Papaipema impecuniosa* Grt. and as it very closely resembled the larva of the latter it was at first mistaken for it. Later studies, however, proved it to be distinct. In Hampson's Catalogue in his table of *Papaipema* this species is placed near *delineata*. Mr. Bird also commented on the splendid work Hampson was doing in this catalogue.

Mr. Barber discussed the "Resurrection of *Thyania calcata* Say from Synonymy." This species he said had been considered synonymous with *Thyanta custator* Fab., but a difference was first noted in the number of chromosomes of the two species by Professor E. B. Wilson, of Columbia University. Mr. Barber had secured as large a series as possible of the two forms, and a careful examination showed that they differed in several characters and were evidently distinct species. Moreover *calcata* seemed to be an eastern and more of a highland form while *custator* occurred in the west and extended south and west.

Dr. Osburn spoke on the distribution of Syrphidae, common to North

America and Europe. He had been studying this question for some time and thought it a very interesting one, because the family Syrphidae was an old one geologically and the larvæ, being largely either predaceous or living upon excrementitious material, were not like many groups, dependent upon some particular food plant. About 400 species of this family were known from North America and a similar number were recorded from Europe, and of these 48 species included in 21 genera were common to both continents. The distribution of the genera was found to be interesting and varied. Of the 64 species of the genus *Syrphus* known to inhabit Europe, 12 are also found in North America; of the 40 or 50 species of *Eristalis* found in Europe 4 occur in America as well. In the large genus *Chilosia*, only one species is common to Europe and America. In other large genera there is no species common to both continents. There are 5 genera in which all the species occur in both Europe and America. Concerning the distribution of these species which inhabit both Europe and America, 40 occur in northeastern America and of these 14 species are not found elsewhere on this continent, 21 of the 40 species are distributed southward into New Jersey and of these 5 do not occur elsewhere in North America. Four of the 40 species found in northeastern America range across the continent to the northwest. In the northwestern part of America 9 species common to both continents occur and of these 5 range southward into British Columbia. From southern British Columbia and northern California 19 species common to both Europe and America are recorded, and of these 15 occur in the eastern and northeastern part of the continent. One species recorded from this locality is found in Arizona and New Mexico and also in the East. One species, *Volucella obesa*, found in Central America, northern South America, Texas and Florida also occurs in the South Seas and Indian Ocean but is not found in Europe. *Sphaerophora cylindrica* has been recorded from Japan and is widely distributed in North America. Ten species are widely distributed all over Europe and North America and among these is *Eristalis tenax* L., which is found throughout the world. The species *Merodon equestris* burrows in lily bulbs in the larval stage and may be distributed in the infested bulbs. It is recorded in America from the eastern United States and Washington. As to how most of this family has been distributed is a question, but it seems probable that the European species common to America may have come by way of Greenland.

Discussion followed as to the various ways in which species were distributed.

Society adjourned.

E. L. DICKERSON,
Secretary.

MEETING OF MARCH 7, 1911.

A regular meeting of the New York Entomological Society was held in the American Museum of Natural History, March 7, 1911, at 8.15 P. M. with

the President, Mr. Leng, in the chair and fifteen members present.

In the absence of Mr. Dickerson Mr. Engelhardt acted as secretary *pro tem.*

Report of Treasurer:

Society account	1,177.39
JOURNAL account	99.75
	\$1,277.14

The report of Curator stated that good progress had been made in the arrangement of local collection of Coleoptera by members of the Society and in the mounting of the museum material collected last season, which will be available at an early date.

The arrangement for a joint field meeting with the Brooklyn Entomological Society over Decoration Day at Yaphank, L. I., was referred to Mr. Engelhardt.

Mr. Olsen's resignation as a member of the field committee was accepted and Mr. Sleight was appointed in his place.

Mr. Comstock spoke on Lycenidae and based his remarks upon material collected by Mr. Hallinan in the Panama Canal Zone, which region he pointed out as a natural dividing line for many North and South American species. A beautiful series of specimens, particularly rich in *Theclas*, was shown. Mr. Hallinan obtained 51 of the 121 species recorded from the Panama Canal region. In flight, Mr. Hallinan mentioned, some of the large iridescent *Theclas* resemble *Morphos*, others persistently frequent the tops of tall thorn trees where their capture requires much patience and considerable forbearance. Thus of *polybe* and *regalis*, after a week's trial, only four specimens were secured.

Mr. Shoemaker told of his collecting experience at Washington, D. C., where he spent two weeks last year during June accompanied by Mr. Davis. He obtained about 3,000 specimens of Coleoptera and Lepidoptera, many of which were new to his collection. Most of the collecting was done on the slopes of the Potomac, both on the Maryland and Virginia sides. Part of his catch including the following species was shown, *Panageus fasciatus* Say, *Platynus caudatus* Lec., *Callida viridipennis* Say, *Odontonyx trivitis* Germ., *Sandalus petrophya* Knoch, *Chalcolepidius viridipilis* Say, *Trichius delta* Forst., *Calligrapha amelia* Knab, *Bellamira scalaris* Say, *Cacopha pullata*, Hald., *Statira croceicollis* Makl., *Nemognatha cibraria* Lec., *Cirrhophanus triangulifer* Grt., *Mamestra marinitincta* Harvey, *Plagiomimicus pityochromus* Grt., *Acontia africana* Hbn. A large number of Carabidae, Scarabaeidae, etc., were captured in bait bottles, of which 70 were planted and regularly inspected. Excepting condensed milk, which proved not very productive, only a mixture of molasses, such as collectors of Lepidoptera generally supply to trees, was used as bait. Mr. Davis showed a number of photographs of the Potomac River region near Washington and also many species of insects of various orders, among them the large bot-fly *Cuterebra horripilum* Clark, the

rare dragonfly, *Neurocordulia obsoleta* Say, and the little cricket *Myrmecophila pergandei*, which latter species, he thought, ought to be found in New Jersey, if looked for in its habitat—ant's nests. Attention was called to the average larger size in a series of *Carabus limbatus* Say from Washington as compared with a series of the same species from the mountains of southern Georgia.

As an instance of the predicament in which a collector is apt to find himself, Mr. Davis cited his experience in the capture of a beetle *Calligrapha amelia* Knab. The beetle was observed in a difficult position for capture among the twigs of a bush of ninebark, its food plant. But what rendered proceedings still more difficult was the discovery of a copper head lying coiled below. Mr. Davis had the satisfaction of exhibiting both beetle and snake.

Mr. Pollard spoke on the occurrence of *Chlorippe celtis* Bdv. & Lec., at Washington where at times the butterfly is exceedingly abundant.

Mr. Davis exhibited 24 specimens of insects that he had found attending the glands on the upper side of the leaves of *Populus grandidentata* and called attention to two of them, a bee of the family Halictidae and a *Crabro* wasp, which he had observed flying from leaf to leaf and visiting many different glands. It was pointed out that the insects were probably not guided by color in this instance, as they would have been in visiting flowers.

Mr. Schaeffer showed a pair of Scarabæid beetles, *Fruhstorferia sexmaculata*, from Tonkin, China, calling attention to the peculiarly elongated mandibles of the male.

Society adjourned.

G. P. ENGELHARDT,
Secretary pro tem.

MEETING OF MARCH 21, 1911.

A regular meeting of the New York Entomological Society was held in the American Museum of Natural History, March 21, 1911, at 8.15 P. M. President Leng in the chair with six visitors and nineteen members present.

Minutes of February 21 and March 7 meetings read and approved.

Mr. Schaeffer, the librarian, reported the receipt of the following publications:

Zeitschrift fur Wissenschaft. Insektenbiologie, Vol. VII, No. 1.

Mitteilungen Naturhist. Mus. Hamburg., Vol. XXVII.

Coleopterorum Catalogus, Part 27.

Deutsche Entomol. Zeitschrift, 1911, No. 1.

Bull. del lab. di Zoologia generale e agraria, Vol. IV.

The Canadian Entomologist, Vol. XLIII, No. 2.

Memorias del Instituto Oswaldo Cruz., II, No. 2.

Revue Russe d'Entomologie, Vol. X, No. 3.

Zoological Record for 1909. Insects, Vol. XLVI.

He also reported that he had had bound the N. J. List of Insects in four

volumes, Blatchley's Coleoptera of Indiana in 2 volumes, and the last two volumes of the JOURNAL and these were exhibited to the members for examination.

Under scientific discussion Dr. Lutz presented an interesting paper on the "Evolution of the Environment," illustrated by several lantern slides. Owing to his absence, due to sickness, this paper was read in part by Mr. Leng. Dr. Lutz discussed the ways in which the land surfaces were altered and lowered by the action of wind, water and other natural agencies, and through the work of man, and then discussed how changes in vegetation occurred following those in topography, beginning with the mosses and lichens clinging to the bare rocks or those slightly covered with soil and developing to the maximum vegetative condition of the meadow or dense forest.

Dr. Love gave some "Notes on Insect Collecting in the Yellowstone National Park." He stated that he had taken a pleasure trip to the Yosemite Valley, Cal., the Grand Canyon of the Colorado in Ariz., and the Yellowstone National Park, and had collected insects as opportunity served. Dr. Love described the country, illustrating his talk with a number of beautiful lantern slides, and exhibited two boxes of insects of various orders which he had collected. Dr. Osburn inquired whether insects had been found around the hot springs in Yellowstone Park and stated that the dragonfly, *Argia virida*, which was southern in its distribution, had been found in the vicinity of the hot springs there and at Banff, Alberta.

Mr. Davis announced that he had received a letter from Mr. Harris, who was staying at Camden, S. C. Mr. Harris noted that the recent frost had had an injurious effect on vegetation, but that he was finding some interesting collecting. He had been collecting *Cicindela vulgaris* Say and *repanda* Dej., and several specimens of an immaculate form of *Cicindela unicolor* Dej.

Mr. Hallinan reported the following N. J. captures: *Pachnobia salicarum* Wlk., Fairlawn, Bergen Co., April 24, in a meadow; *Euthyatira pudens* Gir., Little Falls, Passaic Co., April 27, at arc light; *Memythus palmii* Hy Edw., Little Falls, Passaic Co., July 4, near arc light; *Calymnia orina* Gn., Little Falls, Passaic Co., July 20, near arc light. The specimens were presented by Mr. Hallinan to the local collection.

Mr. Leng stated that he had received from Mr. W. E. Britton, state entomologist of Conn., a copy of a preliminary list of the Coleoptera of Connecticut and would be glad to obtain from the members any interesting records of capture of beetles in Connecticut.

Society adjourned.

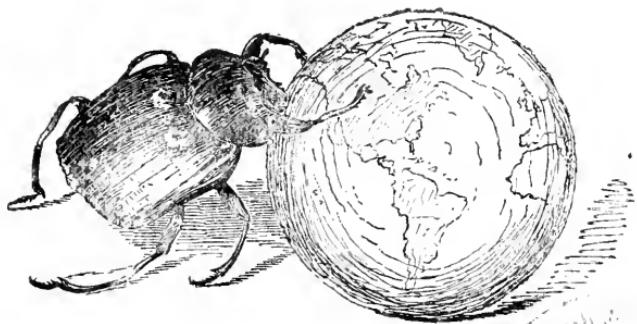
E. L. DICKERSON,
Secretary.

VOL. XX.

No. 3.

JOURNAL
OF THE
NEW YORK
Entomological Society.

Devoted to Entomology in General.



SEPTEMBER, 1912.

Publication Committee.

F. E. LUTZ
CHARLES SCHAEFFER

R. C. OSBURN.
W. M. WHEELER

Published Quarterly by the Society.

LANCASTER, PA.

NEW YORK CITY.

1912.

[Entered April 21, 1904, at Lancaster, Pa., as second-class matter, under Act of Congress of July 16, 1894.]

CONTENTS.

Diptera at Home on Spiders' Webs. By FREDERICK KNAB	143
New Gall Midges or Itonidæ. By E. P. FELT	146
The Haliplidæ of North America, North of Mexico. By ROBERT MATHESON .	156
Miscellaneous Notes.	193
Book Notice.	195
Proceedings of the New York Entomological Society.	197

◆◆◆

JOURNAL

OF THE

New York Entomological Society.

Published quarterly by the Society, at 41 North Queen St., Lancaster Pa., and New York City. All communications relating to the JOURNAL should be sent to the Publication Committee, New York Entomological Society, American Museum of Natural History, New York City; all subscriptions to the Treasurer, Wm. T. Davis, 146 Stuyvesant Place, New Brighton, Staten Is., New York, and all books and pamphlets to the Librarian, John A. Grossbeck, American Museum of Natural History, New York City. Terms for subscription, \$2.00 per year, strictly in advance. *Please make all checks, money-orders, or drafts payable to NEW YORK ENTOMOLOGICAL SOCIETY.*

Authors of each contribution to the JOURNAL shall be entitled to 25 separates of such contribution without change of form. If a larger number be desired they will be supplied at cost provided notice is sent to the Editor before the page proof has been corrected.

JOURNAL

OF THE

New York Entomological Society.

VOL. XX.

SEPTEMBER, 1912.

No. 3.

DIPTERA AT HOME ON SPIDERS' WEBS.

BY FREDERICK KNAB,

WASHINGTON, D. C.

Spiders are generally considered very efficient enemies of Diptera and in truth one frequently finds flies entangled in spider webs. Much has been made of the effectiveness of spider webs in the reduction of mosquitoes and one frequently finds expressions of the most emphatic kind, by economic writers, concerning the usefulness of spiders. I need only call attention to the writings of McCook, John B. Smith and Léon (Roumania). If, however, one searches for accurate observations in support of these statements one finds little more than generalities. In fact species of Diptera belonging to several families of Nemocera have been observed resting unharmed upon spider webs and evidently select this peculiar habitat for repose.

At the meeting of the Entomological Society of Washington on July 6, 1911, Mr. W. L. McAtee presented an observation which showed that at least some species of mosquitoes do not come to grief in spider webs. He found a large number of *Anopheles quadrimaculatus* sitting on a spider web in a hollow tree. They did not stick to the web and on being disturbed they took wing without difficulty. Further observation showed that these mosquitoes returned after having taken flight and were perfectly at home on the web.¹ Since then I have come upon a record of another similar observa-

¹ Proc. Ent. Soc. Wash., Vol. 13, p. 193 (1911).

tion, made in Italy in 1900. It was made by Drs. Sambon and Low during their world-famed malaria experiment in the Roman Campagna. They naturally gave considerable attention to the habits of *Anopheles* and in the final account of their experiment we find the following: "The fully developed *Anopheles claviger* was found in great numbers in the houses, stables and henhouses, frequently resting on cobwebs."¹

Species of at least three other families of Nemocera frequent spider webs. During my trip to Central America, in 1905, I found a species of Cecidomyiidae which was perfectly at home on a spider web. At Port Limon, Costa Rica, on the edge of the jungle, I examined a water-barrel for mosquito larvae. A spider had spun its web over a large part of the open head of the barrel and clinging to the under side of the web were a number of Cecidomyiidae. They were all the one species and evidently at home on the web, for, upon being disturbed, they took flight but soon returned to the web. A number of them were captured, and it was found that both sexes were present. The species has remained undetermined until, a short time ago, I submitted the specimens to Dr. Felt. He has been kind enough to study them and informs me that they are an undescribed species which he has referred to the genus *Coquilletomyia*.²

The following summer, much to my surprise, I found a cecidomyiid with identical habits in the vicinity of Washington. The first specimens were found on webs on the window of a cabin in the woods. They were there in some numbers and behaved in the same manner as those I had taken in Costa Rica. Afterwards I found them repeatedly, I might almost say unfailingly, on the cloth-like webs of certain spiders (probably *Amaurobius*). They were present in considerable numbers, clinging to the under side of a large web, in the hollow of a tree. In the woods I have found them also on webs not particularly sheltered from above, although in such situations they appear to be more rare. As in the Costa Rican case both sexes occur on the webs. I have also submitted specimens of these insects to Dr. Felt and he has kindly examined them. He refers them to the genus *Clinodiplosis* and informs me that they are probably an undescribed species. He has further informed me that in

¹ Brit. Med. Journ., Vol. 2 for 1900, p. 1682.

² Described by Dr. Felt in this number on p. 154.

1906 *Coquilletomyia dentata* Felt was observed in numbers on cob-webs at Newport, New York.

A record of similar habits comes from Australia. Skuse, in the introductory part of his treatment of the Cecidomyidæ, speaks of the imagos frequenting spider webs "sometimes in tens of thousands."¹ Apparently he was under the impression that the habit is general within the family, for no genera or species are mentioned. My own observations lead me to believe that the habit is restricted to certain genera, possibly to certain species of these genera. Dr. Felt informs me that Kieffer has recorded at least one species of Cecidomyide as found on spider webs in Europe, but I have not had the necessary time to search the numerous writings of this author for the record.

In September, 1910, I was surprised to find Diptera of still another family frequenting a spider's web. The web was a large "orb web" of an epeirid, known to be particularly fatal to insects, and was in an exposed situation at the margin of a stream. Upon the threads of this web sat a number of small flies, which, on being frightened, flew off but promptly returned to the web. These flies proved to be Chironomidae and are an apparently undescribed species of the genus *Bessia*. It would seem that in this case there is an obvious reason for the presence of the flies on the web. They are in all probability mess-mates of the spider. There are a considerable number of observations which show that certain species of the group to which the present insect belongs (Ceratopogoninæ) suck the juices of other insects. In the present case the prey of the spider no doubt furnishes a convenient source of food for the flies. The fact that all six of the specimens captured from the web are females supports this view.

In a recent paper on East Indian Tipulidæ, by De Meijere, observations made in Java by Doleschall and by Jacobson are given which show that at least two species of Limnobiinæ habitually suspend themselves from horizontal spider threads and by this means perform a curious dance.²

One of these species is *Dicranomyia saltans* Dol., the other *Mongoma pennipes* O. S. With reference to the first, which is abundant

¹ Proc. Linn. Soc. N. S. Wales, 2 ser., Vol. 3, p. 52 (1889).

² Tijdschr. v. Ent., Vol. 54, p. 22-23, 50-51 (1911).

in shady woods, Jacobson is quoted as follows: "It has the habit to suspend itself with the front legs from spiders' webs; when one of the fore legs are wanting, as frequently happens with these delicate flies, one of the middle legs is utilized. One sometimes sees twenty or more flies close together, suspended from a horizontally stretched spider's thread; they all bob up and down very rapidly, at the same time swaying to and fro, sometimes in unison and sometimes not. This comical rope-dance is continued for a long time. Because the tips of the legs are white they are very plainly visible, while the spider thread on which the flies hang is generally not visible, it appears as if they danced in the air and touched each other with the tips of their front legs." Doleschall, who first observed this curious dance, did not detect the spider threads, which was perhaps due to the fact that his observations were made inside of houses.¹ Jacobson, in the paper quoted above, comments on Doleschall's observation as follows: "If Doleschall describes the flying in a chain without mentioning the spider thread, this is due to incomplete observation. These Dicranomyias never form chains without being suspended from spider threads. These threads are however sometimes so fine that one can only see them from a definite position (so, for example, that they reflect the sunlight)."

Except in the case of the chironomid, no good reason is apparent for the presence of the insects on the spider webs. The habit certainly shows some adaptation. Possibly the web serves as a refuge where these insects may rest secure from other insects. Some explanation should be sought for the fact that these Diptera can frequent the webs without becoming entangled or being preyed upon by the owner.

NEW GALL MIDGES OR ITONIDÆ (DIPT.).

By E. P. FELT,

ALBANY, N. Y.

Below we describe a number of new western forms received through the kindness of Prof. E. Bethel, Denver, Col., and of Mr. P. H. Timberlake, of the U. S. Bureau of entomology.

¹ *Natuurk. Tijdschr. Nederl. Indie*, Vol. 14, p. 390 (1857); quoted by Osten Sacken, *Berl. Ent. Zeitschr.*, Vol. 26, p. 88 (1882).

A new species of *Coquilletomyia* is characterized because it was taken by Mr. Knab on spider webs. It is worthy of note in this connection, that the New York *Coquilletomyia dentata* Felt has been taken in numbers on spider webs at Newport, N. Y., both sexes being captured. A species of *Clinodiplosis* probably undescribed, occurs commonly on spider webs in the vicinity of Washington, D. C., according to Mr. Knab. Recent collecting in the vicinity of Albany shows that a species of *Aphidoletes* may occur commonly on spider webs, returning freely when driven therefrom, the latter indicating this to be a normal habit. A female, *Dasyneura* species, was also captured with the *Aphidoletes*. The light, delicate midges make so little disturbance in alighting upon and leaving the web that the spider appears to ignore them entirely.

Coccidomyia erii, new species.

Male.—Length 1.75 mm. Antennæ nearly as long as the body, sparsely haired, yellowish brown; 14 segments, the fifth with a stem three fourths the length of the cylindric basal enlargement, which latter has a length twice its diameter; terminal segment produced, with a length $3\frac{1}{2}$ times its diameter. Palpi; first segment short, irregular, the second tapering, with a length over thrice its diameter. Mesonotum yellowish brown. Scutellum, postscutellum and abdomen mostly fuscous yellowish. Wings hyaline, costa light straw. Halteres yellowish transparent. Legs pale straw. Genitalia; basal clasp segment long, stout, terminal clasp segment short, swollen. Other organs indistinct.

Female.—Length 1 mm. Antennæ extending to the base of the abdomen, sparsely haired, light straw; 12 segments, the fifth cylindric, sessile, with a length one half greater than its diameter; terminal segment produced, narrowly oval, with a length about $2\frac{1}{2}$ times its diameter. Palpi; first segment subquadrate, the second broadly oval. Mesonotum yellowish brown. Scutellum and postscutellum fuscous yellowish, the abdomen yellowish white. Halteres and legs pale straw. Claws long, slender, unidentate, the pulvilli as long as the claws. Ovipositor as long as the body, the lobes narrowly oval and sparsely setose. Type Cecid a2340.

This small midge was reared in November, 1911, by Mr. P. H. Timberlake from *Artemisia californica* infested with *Eriium lichenoides* Ckll. upon which the midge larvae were presumably predaceous. The material was collected along the Casitas pass road back of Carpenteria, Ventura county, California. This species is easily separated from the allied *C. pennsylvanica* Felt by the sessile antennal segments of the female.

Oligotrophus betheli, new species.

Gall.—Length 7 mm., brown, fleshy, conical and containing an orange or yellowish larva in a central cavity some 3 mm. long.

Female.—Length 1.5 mm. Antennæ hardly extending to the base of the abdomen, sparsely haired, pale yellowish, variably tinged with red; 14 sessile segments, the fifth with a length one half greater than its diameter and with a basal whorl of moderately long, stout spines; terminal segment slightly produced, with a length nearly twice its diameter. Palpi; first segment sub-globose, the second narrowly oval, with a length about twice its diameter, the third about three fourths the length of the second, narrowly oval. Mesonotum yellowish orange, variably tinged with reddish. Scutellum yellowish orange, postscutellum reddish orange. Abdomen deep red, the distal segments yellowish. Wings hyaline, costa light straw. Halteres yellowish basally, slightly fuscous apically. Coxæ pale yellowish, femora and tibiae fuscous, the yellowish tarsi a variable fuscous, the posterior tarsi somewhat lighter. Claws slender, simple, the pulvilli distinctly longer than the claws. Ovipositor short, stout, the terminal lobes broadly oval and sparsely setose.

Male.—Length 1.5 mm. Antennæ with 14 segments, the fifth probably subsessile and with a length about twice its diameter. Genitalia; basal clasp segment short, stout; terminal clasp segment moderately long, stout, slightly curved. Other characters indistinct. Described from a nearly matured fly in the puparial envelope.

Exuviae whitish transparent, antennal sheaths short, stout; wing pads short, stout, the leg cases extending to the third abdominal segment. Type Cecid a2303.

This species was reared June 25, 1912, from a fleshy, apical, conical gall on *Juniperus utahensis* collected by Prof. E. Bethel at McCoy, Col., June 18. The relatively longer antennal segments and the much lighter color differentiate this species from *O. betulae* Winn.

Janetiella coloradensis, new species.

Gall.—Length 4 to 5 mm., diameter 3 mm. This is a more or less regular, oval swelling at the base of the needles, containing near the center, a smooth, oval cell some 3 mm. long.

Larva (dried).—Length 1 mm., broadly oval, yellowish orange. Head broad, moderately well chitinized. Antennæ tapering, uniarticulate. Skin smooth. Breastbone indistinct.

Female.—Length 1.5 mm. Antennæ extending to the second abdominal segment, sparsely haired, probably light brown; 16 sessile segments, the fifth cylindric, with a length $2\frac{1}{2}$ times its diameter and with a sparse whorl of short hairs subbasally and near the middle; terminal segment reduced, broadly oval. Palpi; first and second segments stout, subglobose, the third slender, with a length five times its width, the fourth three fourths the length of the third, somewhat dilated. Mesonotum brownish black, the submedian lines sparsely

haired. Scutellum yellowish, postscutellum yellowish brown. Abdomen yellowish orange, the yellowish ovipositor nearly as long as the body, the terminal lobes narrowly oval, setose. Wings hyaline, costa light straw. Halteres yellowish. Coxæ dark brown; femora and tibiæ pale straw, the tarsi mostly fuscous straw, the pulvilli fully as long as the simple, moderately stout claws. Type Cecid a2287.

The female described above was reared by Prof. E. Bethel, Denver, Col., from oval swellings at the base of pine needles. This species can not be identical with *Cecidomyia pinirigidæ* Pack., since the latter has 14 pedicellate antennal segments, while the form characterized has 16 sessile segments. It may be identical with an eastern species forming similar galls on the scrub pine, *Pinus virginiana* and bearing the name *C. brachynteroides* O. S., an invalid designation, zoologically speaking, since there is no description of an insect, and not even undoubted evidence that Osten Sacken saw the larva responsible for the injury. This species is allied to *J. nodosa* Felt and *J. americana* Felt, the short distal palpal segment separating it from the latter and the color of the abdomen differentiating it from the former.

Asteromyia grindeliæ, new species.

Larva.—Length 2.5 mm., narrowly oval, probably yellowish orange. Head small, broadly rounded. Antennæ short, stout; breastbone short, broad, indistinctly tridentate, the middle tooth broadly rounded, the lateral tooth very broadly and irregularly triangular; shaft stout, densely chitinized and expanded anteriorly and posteriorly; segmentation indistinct; posteriorly broadly rounded; skin coarsely shagreened.

Male.—Length 2.25 mm. Antennæ not extending to the base of the abdomen, sparsely haired, black; 13 segments, the fifth with a length equal to its diameter. Palpi; the one segment is narrowly oval. Mesonotum black, the submedian lines with grayish scales and pubescence. Abdomen with the four basal segments blackish, the three remaining, yellowish; dorsum sparsely covered with a mixture of black and gray scales; venter with grayish scales. Genitalia yellowish brown. Wings hyaline, the third vein uniting with costa a little beyond the middle. Halteres yellowish transparent, the club fuscous basally. Coxæ and femora blackish; tibiæ and tarsi reddish brown. Claws moderately slender, strongly curved, unidentate, the pulvilli about as long as the claws. Genitalia; dorsal plate broad, deeply and roundly emarginate, the lobes narrowly rounded and sparsely setose; ventral plate short, broadly rounded. Harpes moderately long with a stout, quadrate, chitinous tooth apically. Color characters from Timberlake. Type Cecid a2319.

This midge was reared July 27, 1911, from blister leaf galls on *Grindelia robusta* collected by P. H. Timberlake near Santa Barbara,

Cal. This species is easily separated from *A. modesta* Felt by the coloration of the abdomen and the uniarticulate palpi.

Lasioptera verbenæ, new species.

Larva.—Length 2.5 to 3.5 mm., rather slender, deep orange. Head moderate sized, with slender antennæ having a length thrice the diameter; breast bone large, blackish red, tridentate, the median tooth shorter, the shaft well chitinized and with lateral processes anteriorly and posteriorly; posterior extremity narrowly rounded, finely shagreened.

Male.—Length 1.5 mm. Antennæ hardly extending to the base of the abdomen, sparsely haired, reddish; 14 segments, the fifth with a length one-fourth greater than its diameter, the terminal one reduced. Palpi; first segment irregular, the second subquadrate, with a length nearly thrice its diameter, the third a little longer than the second, the fourth one third longer than the third, somewhat dilated. Mesonotum black, submedian lines clothed with brownish and brownish white scales. Scutellum covered with white scales. Abdomen black with five submedian white spots, venter suffused with white scales. Wings hyaline, the third vein uniting with the anterior margin near the middle. Tibiæ and tarsi fuscous, the first tarsal segment and the base of the other segments on the posterior legs white, the other legs with the tarsal segments narrowly annulate with whitish basally. Claws moderately stout, strongly curved, unidentate, the pulvilli shorter than the claws. Genitalia; dorsal plate deeply and narrowly incised, the lobes broadly rounded and sparsely setose; ventral plate long, narrowly rounded. Harpes subtriangular, strongly chitinized.

Female.—Length 2 mm. Antennæ extending to the base of the abdomen, sparsely haired, black; 20 segments, the fifth with a length three fourths its diameter; terminal segment somewhat produced, with a length 2 to $2\frac{1}{2}$ times its diameter. Palpi; first segment irregular, the second with a length $2\frac{1}{2}$ times its diameter, the third as long as the second, somewhat dilated, the fourth a little longer than the third, dilated. Mesonotum fuscous, margined with white scales, the submedian lines ornamented with brownish scales. Scutellum fuscous. Abdomen fuscous with submedian silvery spots posteriorly on the first to fourth or fifth abdominal segments. Similar spots laterally occur on the second to fifth segments. Halteres yellowish white, reddish basally. Legs black, the first tarsal segment and the basal portion of the second to fourth tarsal segments on the hind legs white. Ovipositor when extended about as long as the abdomen, the terminal lobes lanceolate, with a length fully three times the diameter and thickly setose. Coloration after Timberlake. Type Cecid a2313.

This fly was reared from cylindric enlargements of the flower stalks of *Verbenæ prostrata* collected by P. H. Timberlake, November 13, 1910, in the Puente Hills, Whittier, Cal. November 30 one gall was full of healthy larvæ evidently hibernating in silken tubes at-

tached to the walls of the gall. This species is separated from *L. hccate* Felt by the shorter distal palpal segment.

Lasioptera diplaci, new species.

Larva.—Length 2 mm. moderately stout, salmon colored. Head moderate. Antennæ slender, with a length $3\frac{1}{2}$ times the diameter; breastbone tridentate, the median tooth small, the shaft distinct and expanded anteriorly and posteriorly. Skin coarsely shagreened; posterior extremity narrowly rounded.

Female.—Length 2.5 mm. Antennæ extending to the base of the abdomen, sparsely haired, black; 18 segments, the fifth with a length three fourths its diameter; terminal segment somewhat produced, with a length 2 to $2\frac{1}{2}$ times its diameter. Palpi; first segment subquadrate, the second narrowly oval, with a length over twice its diameter, the third one half longer than the second, slender, the fourth a little longer and more slender than the second. Mesonotum black, submedian lines with sparse fuscous hairs. Scutellum fuscous whitish on the margins. Abdomen black, segments 1 to 6 with submedian oval, white spots posteriorly; venter suffused with white scales. Ovipositor stout, brownish, when extended nearly as long as the abdomen, the terminal lobes narrowly oval, with a length about thrice the width and thickly setose. Wings hyaline, the third vein uniting with costa near the middle. Legs black, the first and the base of the second to fifth tarsal segments white. Claws slender, strongly curved, unidentate, the pulvilli as long as the claws. Colors from Timberlake. Type Cecid a2314.

This midge was reared November 24, 1910, from ovoid stem enlargements on *Diplucus longiflorus* collected by P. H. Timberlake in the Puente Hills, Whittier, Cal. This species is closely allied to the preceding.

Asphondylia diplaci, new species.

Gall.—This is a cabbage-like, densely woolly, apical growth of modified leaves having a diameter of about 14 mm.

Exuvia.—Length 4.5 mm., moderately stout; cephalic horns short, obliquely truncate and indistinctly dentate; antennal cases extremely long, leg cases extending to the fifth abdominal segment, wing cases to the third; dorsum of abdominal segments with three well developed transverse rows of stout, chitinous spines, the anterior two somewhat irregular, anteriorly a rudimentary fourth; terminal segment with 4 submedian pair of moderate sized stout spines and two pair of larger lateral spines.

Male.—Length 4.5 mm. Antennæ probably nearly as long as the body, sparsely haired, blackish; 14 segments, the third with a length five times its diameter, the fifth with a length four times its diameter. Palpi; first segment short, irregular, the second with a length four times its diameter, the third slender and one-half longer than the second. Mesonotum grayish black. Scutellum reddish, abdomen grayish black with a grayish white pubescence. Wings hyaline, narrow, with a length $2\frac{1}{2}$ times the width. Legs red, not

very pubescent or scaly. Claws long, slender, evenly curved, the pulvilli a little shorter than the claws. Genitalia; dorsal plate divided, the lobes broadly oval, densely setose; ventral plate deeply and triangularly emarginate, the lobes tapering, narrowly rounded and coarsely setose. Color characters from Timberlake. Type Cecid a2318.

Two dead specimens were removed from a cabbage-like apical growth on *Diplacus longiflorus* collected October 1, 1911, by P. H. Timberlake in the Puente Hills, Whittier, Cal. He also observed a female *Torymus* ovipositing in the gall. This species runs in our key near to *A. sambuci* Felt, from which it is easily separated by the narrow, sparsely haired wings.

Asphondylia enceliæ, new species.

Gall.—Length 10 mm., diameter 4 mm., a leaf bud deformity with walls only about 1 mm. thick, each containing one large, light yellowish larva.

Exuviae.—Length 4 mm., stout, light brown. Leg cases extending to the fourth abdominal segment, wing cases to the third; the dorsum of each abdominal segment with one well developed transverse row of stout, chitinous spines posteriorly and anteriorly two irregular, shorter rows of similar spines; the posterior segment with one median and two pair (sometimes three pair with no median spine) of submedian moderate sized, chitinous spines and two larger lateral spines.

Female.—Length 4 mm. Antennæ nearly as long as the body, sparsely haired, light brown; 14 segments, the third with a length 7 times its diameter, the fifth with a length 5 times its diameter. Palpi; first segment short, irregular, second with a length 2½ times its diameter, the third long, distinctly tapering, with a length twice the preceding. Face light brown. Mesonotum gray, the submedian lines dark gray. Scutellum dark gray, with a whitish pubescence. Abdomen fuscous, the contents reddish and clothed with a dense, grayish white, appressed pubescence; lobes of ovipositor blackish. Wings with a grayish pubescence, thus infuscated and with a length fully twice the width. Halteres orange colored, the club fuscous basally, the stalk light yellowish. Coxæ gray, the remainder of the legs brownish and covered with a short, white pubescence. Claws slender, strongly curved, simple, the pulvilli as long as the claws. Ovipositor when extended as long as the abdomen. Color characters after Timberlake. Type Cecid a2317.

Several specimens were reared February 23 and 25, 1911, from leaf bud galls on *Encelia californica* collected by P. H. Timberlake in the Puente Hills, Whittier, Cal. This species runs in our key to near *A. ilicoides* Felt, from which it is easily separated by the relatively much longer and narrower wings.

Thecodiplosis zauschneriæ, new species.

Gall.—These are apical rosettes or loose cones of leaves occurring on

the dwarfed branches, the larvæ living within the center of the small folded leaves.

Larva.—Length 2.75 mm. moderately stout, probably yellowish orange. Head moderate, the antennæ short, stout; breastbone moderately well chitinized, broadly and triangularly emarginate, the lateral angles short and acute. Skin nearly smooth, posterior extremity broadly rounded and with two pair of obtuse, rather inconspicuous submedian tubercles.

Male.—Length 2.25 mm. Antennæ as long as the body, sparsely haired, light brown; 14 segments, the fifth having the stems with a length 2 and 1½ times their diameters, respectively; terminal segment slightly reduced, basal portion of the stem shorter than the basal enlargement, the distal enlargement subglobose and with a moderately long, stout appendage apically. Palpi; first segment subquadrate, the second probably nearly as long as the third, which latter has a length thrice its diameter, the fourth one fourth longer than the third and somewhat dilated. Mesonotum black, the submedian lines yellowish. Scutellum blackish brown, postscutellum and first abdominal segment blackish, the others yellowish brown. Abdomen sparsely clothed with long, blackish hairs. Wings hyaline, costa light brown. Legs including coxæ light yellowish brown, thickly clothed with black hairs. Claws moderately stout, strongly curved, the pulvilli longer than the claws. Genitalia; basal clasp segment stout, tapering; terminal clasp segment rather short, stout; dorsal plate short, broad, very deeply and triangularly emarginate, the lobes diverging, setose; ventral plate apparently very similar. Harpes somewhat chitinized.

Female.—Length 2.5 mm. Antennæ extending to the fourth abdominal segment, sparsely haired, light brown; 14 segments, the fifth with a stem one third the length of the subcylindric basal enlargement, which latter has a length three fourths greater than its diameter; terminal segment somewhat produced, with a length about thrice its diameter, irregular apically. Mesonotum fuscous, nearly black anteriorly, the submedian lines and posterior median area fuscous yellowish or reddish. Abdomen dark cherry red, sparsely haired on the posterior margins of the segments and laterally. Coxæ light brown. Legs light yellowish, the femora apically golden, the distal half of the front and the base of the middle and hind tibiae, metatarsi and last tarsal segments covered with light-colored hairs. Ovipositor nearly as long as the body, moderately stout, the terminal lobes slender, tapering irregularly apically; color characters after Timberlake. Type Cecid a2311.

Several specimens of both sexes were reared in December, 1910, by Mr. P. H. Timberlake from rosette galls on *Zauschneria californica* collected in the Puente hills back of Whittier, Cal. The galls were reported as being abundant everywhere through the hills. This species is separated from *T. hudsonici* Felt by the longer basal portion of the stem of the fifth antennal segment and the relatively shorter fourth palpal segment.

Clinodiplosis araneosa, new species.

Male.—Length 1.5 mm. Antennæ one half longer than the body, thickly haired, probably light brown; 14 segments, the fifth with the stems $2\frac{1}{2}$ and 3 times their diameters, respectively; terminal segment produced, the basal portion of the stem with a length four times its diameter, the distal enlargement cylindric, with a length thrice its diameter and apically a long, slender, tapering process. Palpi; first segment irregularly fusiform, the second segment with a length about four times its diameter, the third a little longer and more slender, the fourth one fourth longer than the third, somewhat dilated. Mesonotum probably light brown. Scutellum and postscutellum probably fuscous yellowish. Abdomen probably yellowish brown. Wings hyaline, costa light straw. Halteres and legs yellowish straw. Claws slender, strongly curved, those of the anterior and mid legs unidentate, the pulvilli about one third the length of the claws. Genitalia; basal clasp segment long, stout; terminal clasp segment long, slender; dorsal plate broad, deeply and triangularly incised, the lobes obliquely truncate; ventral plate moderately broad, broadly emarginate, the lobes short and broad.

Female.—Length 2 mm. Antennæ extending to the fourth abdominal segment, thickly haired, yellowish brown; 14 segments, the fifth with a stem one half the length of the cylindric basal enlargement, which latter has a length $2\frac{1}{2}$ times its diameter. Mesonotum reddish brown, the submedian lines yellowish. Scutellum pale yellowish, postscutellum light brown. Abdomen mostly yellowish brown, sparsely haired. Halteres pale yellowish. Legs light straw. Ovipositor about one half the length of the abdomen, the terminal lobes narrowly lanceolate, with a length about $2\frac{1}{2}$ times the width. Type Cecid a2277.

A number of midges belonging to this species were received in 1912 from Mr. Frederick Knab accompanied by the statement that they occur commonly about Washington, D. C., on spider webs. The material studied was captured August 30 at Cabin John, Md. Allied to *C. caulincola* Coq., from which it may be separated by the short, broad lobes of the ventral plate.

Coquilletomyia knabi, new species.

Male.—Length 1 mm. Antennæ twice the length of the body, rather thickly haired, light brown; 14 segments, the fifth having the stems with a length 3 and 4 times their diameters, respectively, the distal enlargement subcylindric, with a length about twice its diameter, the circumfili well developed, the loops of the distal filum attaining the apex of the segment. Palpi; first segment subglobose, the second with a length four times its diameter, swollen distally, the third one half longer than the second, slender, the fourth one fourth longer than the third, slightly dilated. Mesonotum slaty brown, the submedian lines and scutellum fuscous yellowish, postscutellum slightly darker, the abdomen sparsely white-haired, dark brown.

Wings hyaline, the third vein well beyond the apex. Halteres yellowish basally, fuscous apically, the legs fuscous yellowish, the distal tarsal segments somewhat darker; claws stout, strongly curved, the anterior unidentate, the pulvilli rudimentary. Genitalia: basal clasp segment slender, with a conspicuous, quadrate, thickly setose lobe basally; terminal clasp segment long; dorsal plate short, broadly and triangularly emarginate; ventral plate short, broad, broadly rounded, the distal third thickly short-spined. Harpes rather weakly chitinized; style long, the distal fourth slender, with about 12 feebly chitinized teeth.

Female.—Length 1.25 mm. Antennæ as long as the body, sparsely haired, dark brown; 14 segments, the fifth with a stem one fourth the length of the cylindric basal enlargement, which latter has a length $2\frac{1}{2}$ times its diameter; the terminal segment cylindric, with a length seven times its diameter and apically a somewhat fusiform, stout process one third the length of the entire segment. Palpi; first segment with a length nearly thrice its diameter, the second one half longer, somewhat dilated, the third a little shorter than the second, more slender, the fourth one half the length of the third, more slender. Mesonotum reddish brown, the submedian lines indistinct. Scutellum and postscutellum yellowish brown. Abdomen sparsely haired, dark brown. The short ovipositor yellowish, the sparsely haired terminal lobes slender, with a length five times the width. Other characters nearly as in the male.

A number of males and females were captured on a spider web in a rain barrel at Port Limon, Costa Rica, September 24, 1905, by Frederick Knab. This undescribed form is provisionally referred to the above genus, though in certain respects it appears to closely approach *Feltiella* Rubs. It may be distinguished from *C. dentata* Felt by the dark brown abdomen and the quadrate basal process of the basal clasp segment.

Karschomyia townsendi, new species.

Male.—Length 1.75 mm. Antennæ one fourth longer than the body, thickly haired, light straw; 14 segments, the fifth having each stem with a length $3\frac{1}{2}$ times its diameter, the distal enlargement subcylindric, with a length one half greater than its diameter and a very thick whorl of long, strongly curved, slender setæ, circumfili well developed; terminal segment, basal portion of the stem with a length 7 times its diameter, the distal enlargement greatly produced, tapering distally, with a length four times its diameter and apically a long, finger-like process. Palpi; first segment subquadrate, the second with a length over thrice its diameter, the third a little longer and more slender than the second, the fourth one fourth longer than the third. Mesonotum fuscous yellowish orange. Scutellum, postscutellum and abdomen yellowish orange. Genitalia somewhat fuscous. Wings hyaline, costa light straw. Halteres yellowish transparent, slightly fuscous. Coxæ

yellowish orange. Legs mostly a nearly uniform light brown. Claws slender, strongly curved, the anterior and mid unidentate, the pulvilli rudimentary. Genitalia; basal clasp segment short, subquadrate; terminal clasp segment one half longer than the basal, distinctly swollen near the middle, strongly chitinized; dorsal plate broad, broadly and triangularly emarginate, the obtuse lobes setose; ventral plate narrow, greatly produced, narrowly rounded; setose apically. Harpes strongly chitinized.

Female.—Length 2 mm. Antennæ nearly as long as the body, sparsely haired, dark brown; 14 segments, the fifth with a stem three fourths the length of the basal enlargement, which latter has a length $2\frac{1}{2}$ times its diameter; terminal segment produced, the cylindric basal enlargement with a length four times its diameter and apically with a long, moderately stout process, the latter greatly swollen basally. Palpi; first segment irregular, the second slender, with a length four times its diameter, the third nearly as long as the second, more slender, the fourth as long as the second, slender. Mesonotum reddish brown, the submedian lines yellowish orange. Scutellum fuscous yellowish, postscutellum and abdomen mostly yellowish orange. Ovipositor short, the terminal lobes broadly oval and sparsely setose, otherwise nearly as in the male. Type Cecid a2308.

The remarkable form described above was collected by Prof. C. H. T. Townsend in and near a tent in Montaña of the Province of Jaen, northern Peru, in September, 1911, Rio Charape. The elevation was about 5,000 feet and at the upper limits of the tropical rain-forest region. This species is tentatively referred to the above named genus because it runs thereto in our key and exhibits affinities therewith on account of the greatly produced ventral plate and the strongly chitinized harpes. The greatly produced stems of the flagellate antennal segments separate this species from *K. viburni* Felt.



THE HALIPLIDÆ OF NORTH AMERICA, NORTH OF MEXICO.

BY ROBERT MATHESON,

ITHACA, N. Y.

Family HALIPLIDÆ.

1832. Dyticea, Tribus V, Erichson, Genera Dyt., p. 46. 1836. Hydrocanthares, Tribus Haliplides, Aubé, Icon. Col. Eur., V, p. 15. 1838. Hydrocanthares, Tribus Haliplides, Aubé, Species Col., VI, p. 2. 1837. Dytiscidæ, Gruppe Haliplini, Erichs, Käf. Mk. Brandbg., p. 183. 1859. Haliploidae, Thoms.

Skand. Col., I, 1859, p. 11; II, 1860, p. 2. 1868. Dytiscidæ, Gruppe Haliplini, Schaum, Kiesw. Naturg. Ins. Deutsch., I, 2, 9. 1873. Dytiscidæ, Subfamily Haliplidæ, Crotch, G. R., Trans. Amer. Ent. Soc., IV, p. 383. 1878. Dytiscidæ, Tribus Haliplinae Régimbart, Ann. Soc. Ent. Fr., VIII (5), p. 449. 1881. Haliplidæ, Bedel, Fn. Col. Bass. Seine, I, p. 2, 219. 1881. Haliplidæ, Horn, Trans. Amer. Ent. Soc., IX, p. 94. 1883. Haliplidæ, Leconte and Horn, Classification Coleoptera North America, p. 60. Dystiscidæ, Subfamily Haliplini Seidl, Best. 19. 1885. Haliplidæ, C. Van den Branden, Catalogues des Coléoptères carnassiers aquatiques, Ann. Soc. Ent. Belg., pp. 7-12. 1892. Haliplidæ, Ganglbauer, Die Käfer von Mitteleuropa, I, p. 422. 1901. Haliplidæ, Sharp, Cambridge Natural History, VI, p. 209.

The Haliplidæ are a family of small, aquatic beetles placed by systematists close to the Dytiscidæ and probably representing a transition group between the Carabidæ and the former family. This group was first recognized as a separate family by C. G. Thomson (Skand. Col., I, 1859, p. 11). Since then the family has been variously regarded. Some workers have placed it as a tribe, others as a subfamily of the Dytiscidæ.

The family contains only three genera, the genus *Haliplus* being world wide in its distribution. The total number of known species is about one hundred and twenty-five. The genus *Haliplus* is represented in North America by about fifteen species, *Peltodytes* by nine, and *Brychius* by one. This does not in any way indicate the total number of species, for the beetles are small, not usually observed by collectors, and the family has been sadly neglected by systematists.

The Haliplidæ may be separated from the closely allied families by the following characters:

Antennæ 10-jointed, inserted on the front between the eyes, under a small ridge; filiform, almost smooth, scattered setæ being present (Figs. 1 and 2); clypeus extending laterally to the points of insertion of the antennæ, the suture separating it from the front not being very distinct, especially at the sides; gula well defined, broad behind, gradually narrowing at first and then suddenly broadly expanding in front (Fig. 11, g); eyes entire, not emarginate.

The prosternum is prolonged anteriorly, forming a prominent ridge, steeply declivous in front, into which the head fits closely (Fig. 12).

Metasternum with a well marked ante-coxal piece, the suture ex-

tending all the way across the metasternum and bordered by a row of large punctures; antecoxal piece triangular in outline, the apex extending between the posterior coxae.

Anterior and middle coxae globular; the posterior coxae plate-like, extending laterally to the pleurae of the elytra and covering the first 3-5 segments of the abdomen; between the posterior coxae and the abdomen the dumbbell-shaped femora of the hind legs move; outer anterior ends of the posterior coxae prolonged into knob-like structures, closely fitting into socket-like depressions in the elytra. By this means the elytra are held firmly in place.

Abdomen with six ventral segments, the first three grown together and covered by the posterior coxae.

A more detailed discussion of the external morphology may now be given. The head is small, closely fitting into the prothorax which extends a short distance over it. The eyes are prominent, usually strongly convex, not emarginate. The clypeus is well defined, truncate in front. Labrum truncate or emarginate, its anterior edge thickly set with hairs. The mandibles (Fig. 10) are curved, pointed, each with a single tooth on its inner margin. The maxillæ consist of the typical parts well differentiated. In *Haliplus* they are more elongate and narrower than in *Peltodytes* (Figs. 3 and 5) but in general they correspond fairly well. The stipes articulates directly with the cardo and attached along the sides of the stipes are the subgalea (*sg*, Fig. 5) and the well developed palpifer (*pl*, Fig. 6). The palpifer bears the 4-segmented palpus and articulates with the dorsal edge of the lacinia (*lc*, Figs. 4, 5). On the dorsal side in *Peltodytes* it overlaps the distal end of the stipes and nearly covers the subgalea (Fig. 6). It will be noted that the palpifer is very large.

The subgalea is attached along its inner edge to the stipes while distally it bears the lacinia. Attached to the subgalea is the large adductor muscle of the maxilla (*a*, Fig. 4). The 2-segmented galea is attached to the distal outer edge of the subgalea and closely overlies the lacinia. In the figures the galea is shown somewhat separated from the lacinia. Sense pits are found scattered over the galea, more abundant towards its distal end. These sense pits are more numerous in *Peltodytes* (Fig. 5). The lacinia is a large, rather clumsy looking affair. It ends distally in a long, pointed claw and its inner edge is furnished with a row of large, somewhat lanceolate

spines. The shapes of the spines differ in the two genera (Figs. 3 and 5). The palpus is 4-segmented. In *Haliplus* the last segment is subulate, shorter than the preceding one. Sensory pits are few and scattered. In *Peltodytes* the last segment is conical, longer than the preceding one and the whole palpus bears many sensory pits (Fig. 5).

The labium is well developed. The submentum is large, trilobed, the outer lobes prominent. The median lobe is entire in *Peltodytes* (Fig. 9), emarginate in *Haliplus* (Fig. 7). In *Peltodytes* the mentum is small and the suture separating it from the glossæ and the paraglossæ is lacking. However the two prominent setæ situated near the median plane of the distal end of the labium and the lateral sutures indicate the positions of the fused glossæ. The paraglossæ are fused with the mentum at their bases. A few sensory pits are present along the distal margin of the labium. In *Haliplus* the mentum is large and separated from the distal part by a distinct suture. The glossæ and paraglossæ are fused though the two prominent setæ indicate clearly the position of the glossæ (Fig. 7). Many large, deeply sunken setæ are found on the distal portion of the labium. One is shown in detail in Fig. 8. These peculiar structures are probably sensory.

The labial palpi are 3-jointed. In *Haliplus* the last segment is subulate and shorter than the second; in *Peltodytes* it is conical and longer than the second. The palpiger is large and prominent, especially so in *Peltodytes* (Fig. 9).

The pronotum is narrowed in front, partially overlapping the head. In *Brychius* the pronotum is quadrate, not narrowed in front. The posterior margin is angulate, the projecting angle fitting closely in between the bases of the elytra and concealing the scutellum. The prosternum is large, broad, and steeply declivous in front, fitting closely over the posterior portion of the head. Posteriorly it almost conceals the mesosternum and fits closely over the projecting median portion of the metasternum. This solid union with the mesosternum beneath and the metasternum behind adds greatly to the rigidity of the skeleton. The episternum does not reach the coxa, being separated from it by the forward projection of the epimeron (Fig. 11, *em*). The epimeron is narrow. Its inner edge projects between the episternum and coxa and reaches the prosternum in front. It thus forms the lateral margin of the coxal cavity. The coxal cavities are open behind (Fig. 11, *c*).

The mesosternum (*ms*, Figs. 11 and 12) is hidden beneath the intercoxal projections of the metasternum and prosternum. It is quite solidly fused with pro- and metasterna. The episternum (*cp*, Figs. 11 and 12) is a broad, irregular sclerite. It does not reach the coxal cavity. The epimeron (*cm*) is nearly quadrate in outline and extends to the coxal cavity.

The metasternum is very broad behind, narrowed in front where it extends between the middle coxae and is solidly fused with the prosternum. The antecoxal sclerite is triangular in outline, the apex projecting between the posterior coxae. The episternum (*cp*, Figs. 11 and 12) is a long, narrow sclerite, wide in front, narrowed behind and lies almost parallel to the median plane of the body. It extends from the meso-episternum to the posterior coxa. The epimeron is a thin, narrow sclerite lying directly laterad of the episternum.

The anterior and middle coxae are globular. The posterior coxae are in the form of flat plates, meeting in the middle line and covering the first three to five abdominal segments. They extend laterally to the pleurae of the elytra. At the anterior outer end of each is a somewhat rounded knob which fits closely into a socket-like depression of the elytron. (Figs. 15 and 17.)

The anterior and middle femora are club-shaped, slightly flattened so as to increase the striking surface in swimming. The posterior femora are dumbbell-shaped, the proximal end being the larger (Figs. 15 and 17). The anterior and middle femora and tarsi of all the legs are furnished with long swimming hairs. The first three segments of the tarsi of the anterior and middle pairs of legs of the male are somewhat broadened at the distal ends and the under sides provided with hairs for clinging (Fig. 18).

Each elytron is provided with ten rows of punctures which vary considerably in depth and size in the various species. In the greater number of species the elytra are marked with black spots or lines which are very characteristic of this family. (See photographs, Plate xv.) These markings, however, usually exhibit considerable range of variation within the same species.

A discussion of the habits, life-histories, etc., follows in the second part of this paper.

The three genera may be readily separated by the following key.

- A.* Terminal joint of palpi small, subulate, shorter than the preceding. Posterior coxae concealing only the first three segments of abdomen.
- B.* Pronotum quadrate, widest in front of the middle; two lateral basal impressions present extending more than half the length of the pronotum. Fourth tarsal segment scarcely shorter than the first.
- Brychius* Thomson.
- BB.* Pronotum strongly narrowed and truncate in front, widest at the base, above strongly convex. Fourth tarsal segment much shorter than the first *Haliphus* Latreille.
- AA.* Terminal joint of palpi large, conical, longer than the preceding. Posterior coxae concealing all but the last segment of abdomen. Pronotum strongly narrowed and truncate in front, convex above. Fourth tarsal segment shorter than the first..... *Peltodytes* Regimbart.

BRYCHIUS Thomson.

Brychius Thomson, C. G. Skand. Col. II, 1859, p. 8.

Type.—*Dytiscus elevatus* Panz. Fn. Germ., XIV, p. 9.

The genus *Brychius* is easily distinguished from the other two genera through the quadrate form of the pronotum and the narrow, more elongate form of the body. The sides of the pronotum are sinuate, widest just in front of the middle. Well marked basal impressions (striola of some authors) are present, reaching beyond the middle of the pronotum. The elytra are marked with ten rows of punctures. The tarsi are five segmented, long and slender. The claws are long.

The genus contains five European and one North American species. So far as known they all live in running water.

Brychius hornii Crotch.

Brychius hornii Crotch. Trans. Amer. Ent. Soc., IV, 1873, p. 383.

General color pale yellow with black markings on elytra. Length 3.5-4 mm.

Head pale yellow, punctate; antennæ yellowish: labrum emarginate, rounded at the sides, a row of small setæ on the anterior margin.

Pronotum quadrate, the lateral margins sinuate, basal impression present and exceeding one half the length of pronotum, punctate, the disc smooth. Prosternal ridge margined, not grooved, convex laterally and longitudinally, punctate, sharply declivous in front, the sides constricted in the region of the prothoracic legs, widening anteriorly. Legs yellowish, posterior coxae punctate, rounded behind, not reaching the fourth segment of abdomen. Abdominal segments shining, punctate.

Elytra yellowish with ten rows of black punctures, intervals rarely punctate. Posterior half of the margins of the clytra denticulate.

Described from specimens received from Prof. H. F. Wickham, Iowa City, Iowa. Collected at Kalispel, Montana. Prof. E. T. Cresson, Jr., has kindly compared my specimens with the type.

Type.—In the museum of the Philadelphia Academy of Sciences, Philadelphia, Pa.

Habitat.—California and Montana.

HALIPLUS Latreille.

Haliphus Latreille, Hist. Nat. Ins., III, 1802, p. 77.

Cnemidotus Illiger non Erichson. Illiger Mag., 1802, p. 373.

Hoplitus Clairville, Ent. Helv., II, p. 218.

Type.—*Dytiscus ruficollis* DeGeer. Memoires Ins., 1774, p. 404.

Terminal segment of the palpi subulate, shorter than the preceding; palpi with but few sensory pits. Submentum trilobed, the median lobe strongly emarginate. Pronotum truncate, strongly narrowed in front, convex above, widest at the base. Elytra with the rows of punctures regularly arranged; intervals with fairly regularly arranged smaller punctures. The posterior coxae conceals the first three segments of the abdomen. Hind tarsi as long as or longer than the tibiae; first tarsal joint longer than the fourth; claws small.

This genus contains by far the largest number of species, in all over one hundred, widely distributed. They live in pools, stagnant water, etc., and are abundant usually where there is a supply of filamentous algae growing. The habits of the adults, their life-histories, etc., will be fully discussed in the second part of this paper.

KEY TO THE SPECIES OF HALIPLUS.

- A. Pronotum with paired basal impressions (striolæ).
- B. Prosternum deeply grooved; elytral spots distinct, prominent; basal impressions less than one third the length of pronotum.
 - ruficollis* DeGeer.
 - BB. Prosternum not deeply grooved; elytral spots usually indistinct, small, or sometimes entirely wanting; basal impressions more than one third the length of the pronotum. *longulus* Leconte.
- AA. Pronotum without paired basal impressions.
 - C. Prosternum not margined, flat or slightly convex or concave laterally.
 - D. Species entirely rufous, punctures on elytra, especially at base, being slightly dark *vancouverensis*, n. sp.
 - DD. Species not entirely rufous, yellowish in color with black markings always present.

- E.* Disc of pronotum without a transverse depression; elytral punctures deep and prominent *cribrarius* Leconte.
- EE.* Disc of pronotum with a prominent transverse depression; elytral punctures shallow; species smaller, paler colored.
nitens Leconte.
- CC.* Prosternum distinctly margined.
- F.* Metasternum with a deep square impression. *tumidus* Leconte.
- FF.* Metasternum without such a deep, square impression.
- G.* Species entirely rufous, without black markings.
- H.* Species small, not exceeding 2.5 mm.; no definite rows of interstitial punctures on elytra. *concolor* Leconte.
- HH.* Species larger, 3.5-4 mm.; interval with definite rows of small punctures *mimeticus*, n. sp.
- GG.* Species not entirely rufous; black markings always present.
- I.* Species small, not exceeding 3 mm.
- J.* Apices of elytra strongly sinuate. *borealis* Leconte.
- JJ.* Apices of elytra not strongly sinuate.
- K.* Pronotum with a small rounded rufous spot on anterior margin; elytra with prominent black markings, their apices obliquely truncate.
deceptus, n. sp.
- KK.* Pronotum immaculate; markings on elytra indistinct and more or less confluent; apices of elytra rounded *lewisii* Crotch.
- II.* Species larger, none shorter than 3.5 mm.
- L.* Anterior margin of pronotum with a large, oval, black spot.
- M.* Species bright rufous with black markings; disc of pronotum punctate; apices of elytra rounded; species larger, 4-4.5 mm. *punctatus* Aubé.
- MM.* Species never bright rufous, pale yellow with black markings; disc of pronotum smooth; apices of elytra very obliquely truncate; species smaller, 3.5 mm. *triopsis* Say.
- LL.* Pronotum immaculate.
- N.* Prothorax broad; elytral spots large, usually not connected; sutural stripe broad, the portion in front of the median spot always extending to the first row of large punctures; apices of elytra not denticulate.
fasciatus Aubé.
- NN.* Prothorax narrow; elytral spots smaller, nearly always connected by fine black lines; sutural stripe narrow, never reaching the first row of large punctures; apices of elytra denticulate.
conneatus, n. sp.

Haliplus concolor Leconte.

Haliplus concolor Leconte. Ann. Lye. Nat. Hist., V, 1852, p. 201.

Species entirely rufous. Length 2.5 mm.

Head sparsely punctate, the punctures very small; labrum truncate, the anterior margin with a row of fine setæ.

Pronotum with a pair of small, basal, dark areas, punctate, the disc sparsely so, punctures of the sides and front smaller than those of the base. Prosternal ridge margined, deeply grooved in front, punctate. Posterior coxae rounded behind, punctate, reaching the fourth segment of the abdomen; abdominal segments shining, smooth, a few scattered punctures being present.

Each elytron with ten rows of punctures of the same color as the elytra; punctures not so deeply impressed towards the tip; intervals with few small punctures; apices of elytra rounded, not sinuate.

Re-described from one specimen collected at Brownsville, Texas. In the collection of Prof. H. F. Wickham, Iowa City, Iowa.

Habitat.—Colorado River (Leconte); Texas (Brownsville, H. F. Wickham).

Type.—In the Museum of Comparative Zoology, Cambridge, Mass. Described originally by Leconte from one specimen from the Colorado River.

Haliplus connexus, new species.

Color pale yellow, rarely rufous, with black spots and margins on elytra. Length 4 mm.

Head punctate except a small area on vertex; eyes nearly circular in outline; labrum emarginate, rounded at the sides, a row of fine setæ on anterior margin; antennæ testaceous.

Thorax entirely pale yellow, rarely rufous; pronotum punctate except a linear transverse area on disc, the punctuation stronger at base than at sides and front; punctures of same color as thorax; paired basal impressions wanting; prosternal ridge margined, convex transversely and longitudinally, not grooved, sharply declivous in front, sides slightly constricted in region of prothoracic legs, widening again anteriorly. Abdominal segments smooth and shining, the last one triangular in outline and punctate at apex and sides, the base impunctate; the remaining segments except the third, each with a row of punctures on posterior margin. Legs pale yellow, posterior coxae punctate, rounded posteriorly, extending to the fourth segment of abdomen.

Elytra with black spots and margins more or less connected by fine lines as shown in Plate XV, the spots and margins not so large and more connected than in *H. fasciatus* Aubé. The sutural stripe never reaches the first row of large punctures in front of the median black spot as it always does in *fasciatus* and this makes one of the most available characters for separating these closely allied species. Each elytron has ten rows of shallow punctures

of the same color as elytra; intervals with fairly well defined rows of small punctures; margin of elytra not sinuate before the apex, denticulate.

Habitat.—Canada (Nova Scotia); Mass. (Amherst); New York (Ithaca); Michigan (Lansing); Illinois (Lake Forest).

Type.—In the entomological collection of Cornell University, Ithaca, N. Y.

***Haliphus longulus* Leconte.**

Haliphus longulus Leconte. Lake Superior, Agassiz and Cabot, Note 31, 1852, p. 211.

General color rufous to pale yellow with black markings on elytra, these markings indistinct or sometimes wanting.

Head punctate; eyes oval; labrum slightly emarginate, rounded at the sides, a row of small setæ on the anterior margin.

Pronotum punctate, the disc sparsely so, punctures of the same color as the pronotum; paired basal impressions present, exceeding one third the length of the pronotum. Prosternal ridge not grooved, or only slightly so in front, punctate, sharply declivous in front. Abdominal segments shining, smooth, each except the last with an indefinite row of small punctures near the apex; last segment triangular in outline, punctate. Legs rufous; posterior coxae punctate, reaching the fourth segment of abdomen.

Elytra rufous to almost pale yellow with the black markings indistinct or sometimes wanting. Each elytron with ten rows of punctures, the outer two rows usually the same color as elytra, the others black; intervals with a few scattered, black punctures, sometimes arranged in fairly definite rows; apical margins of elytra rounded.

Re-described from specimens which were compared with the type of Leconte.

Habitat.—Canada (Nova Scotia); Mass. (Cambridge); New York (Pike, Kerner, Ithaca); Indiana (Pine, Lake Co., Broad Ripple, Marion Co., Blatchley, 1910); Mich.; Wis. (Three Lakes, Dane Co., W. S. Marshall); Isle Royale (Lake Superior, H. F. Wickham); Colorado; Cal. (Arcata, Humboldt Co., E. C. Van Dyke).

Type.—In the museum of Comparative Zoology, Cambridge, Mass.

***Haliphus fasciatus* Aubé.**

Haliphus fasciatus Aubé. Species des Col., VI, 1838, p. 30.

General color rufous to pale yellow with black spots and margins on elytra. Length 4-4.5 mm.

Head punctate except a small area on vertex; eyes nearly circular in outline; labrum slightly emarginate, rounded at the sides, a row of setæ on its anterior margin; antennæ rufous.

Thorax rufous to pale yellow; pronotum strongly punctate except a

linear transverse area across the disc; punctuation stronger at the base than in front or at sides; paired basal impressions wanting. Prosternal ridge margined, convex transversely and longitudinally, sharply declivous in front, sides straight, slightly widening in front, punctate. Abdominal segments smooth and shining; third segment punctate at sides, fourth and fifth each with a row of punctures along posterior margins; the last segment triangular in outline, punctate at tip and sides. Legs rufous to pale yellow; posterior coxae strongly punctate, rounded posteriorly, reaching the fourth segment of the abdomen.

Elytra with large well-defined black spots and margins. These markings are fairly constant in this species as compared with other species in this genus. Each elytron has ten rows of large punctures of the same color as the elytra; each interval with a well defined row of small punctures; apical margins of elytra not denticulate.

Habitat.—Mass. (Amherst); New York (Esopus, one specimen); Pa.; Georgia (Spring Creek, Decatur Co., J. C. Bradley); Texas (Dallas).

***Haliplus lewisii* Crotch.**

Haliplus lewisii Crotch. Trans. Amer. Ent. Soc., IV, 1873, p. 384.

General color pale yellow with dark markings on head and elytra. Length 2.5 mm.

Head punctate, infuscate on vertex; antennæ pale yellow; labrum slightly emarginate, a row of small setæ on its anterior margin.

Pronotum punctate, the disc only slightly so; punctures of the base slightly larger than those of the sides and apex; punctures of the same color as the thorax. Prosternal ridge margined, punctate, not grooved, sharply declivous in front. Abdominal segments smooth, shining, punctate on their apices. Posterior coxae punctate, rounded posteriorly, reaching the fourth segment of the abdomen.

Elytra pale yellow with dark markings. Each elytron with ten rows of punctures of the same color as elytra; intervals sparsely punctate; apices not sinuate, rounded, slightly denticulate.

Re-described from specimens from Dane Co., Wis. (W. S. Marshall).

Habitat.—Texas (G. R. Crotch; Cameron Co., H. F. Wickham); Indiana (Broad Ripple, Marion Co., Blatchley).

—In the Entomological Collection of the Philadelphia Academy of Sciences, Philadelphia, Pa.

***Haliplus deceptus*, new species.**

General color pale yellow with darker spots on elytra and pronotum. Length 3 mm.

Head punctate; labrum emarginate, rounded at the sides, a row of setæ on its anterior margin; antennæ pale yellow.

Pronotum pale yellow with a rounded rufous spot on its anterior margin, punctate, the disc sparsely so. Prosternal ridge margined, not grooved, convex laterally and longitudinally, sharply declivous in front. Abdominal segments smooth, shining, each with a row of punctures on its posterior edge. Posterior coxae punctate, rounded behind, reaching the fourth segment of the abdomen.

Elytra with well-defined black spots (Plate XV); each with ten rows of shallow punctures of the same color as the elytra; intervals with fairly well defined rows of small punctures; apices obliquely truncate, not sinuate, denticulate.

This species is readily separated from *H. borealis* Lec. by the apices of the elytra not being sinuate and from *H. lewisii* Crotch by the presence of the rufous spot on the apex of the pronotum and the well-defined arrangement of the black spots on the elytra.

Described from two specimens from Texas. From the collection of the Michigan Agricultural College, East Lansing, Mich.

Habitat.—Texas.

Type.—In the entomological collection of Cornell University, Ithaca, N. Y. Paratype in the collection of the Michigan Agricultural College, East Lansing, Mich.

***Halipplus punctatus* Aubé.**

Halipplus punctatus Aubé. Spec. des Col., VI, 1838, p. 32.

General color rufous with black markings on thorax and elytra. Length 3.75–4 mm.

Head punctate except for a small area on vertex; labrum emarginate, rounded at sides, a row of setæ on its anterior margin; antennæ rufous.

Pronotum with a large, black spot on its anterior margin; punctate except the disc which is sparsely so; punctures of the same color as thorax, smaller on sides and anterior margin; prosternal ridge punctate, concave laterally, convex longitudinally, the sides nearly straight, steeply declivous in front; metasternum with a narrow, longitudinal groove along its median plane; posterior coxae punctate, reaching the fourth segment of abdomen, the hind margins somewhat sinuate. Abdominal segments smooth and shining, each, except the last, with a row of small punctures on its posterior margin; the last segment triangular in outline, punctate at its apex.

Elytra with ten rows of punctures, shallow, of the same color as the elytra; intervals with a definite row of small punctures; black markings present and arranged as shown in Plate XV. Apex of each elytron obliquely truncate, slightly denticulate.

Habitat.—Middle and Southern States (G. R. Crotch, 1873).

***Haliphus borealis* Leconte.**

Haliphus borealis Leconte. Lake Superior, Agassiz and Cabot, 1850, p. 212.

General color pale yellow to rufous with black markings on elytra. Length 2.5-3 mm.

Head punctate, infuscate to black on vertex; labrum rounded at the sides, slightly emarginate, a row of small setæ on the anterior margin; antennæ pale yellow.

Pronotum without basal impressions, punctate except on the disc, the basal punctures largest. Prosternal ridge margined, convex longitudinally and laterally, punctate. Abdominal segments smooth and shining, punctate along their posterior margins. Posterior coxae punctate, rounded posteriorly, reaching the fourth segment of the abdomen.

Each elytron with ten rows of black punctures, the intervals with but few small, scattered punctures. Apices of elytra strongly sinuate. This latter character is probably the most specific and easily used for identification.

Habitat.—Lake Superior (Leconte); Indiana (Laporte Co., Blatchley); Iowa (Iowa City, H. F. Wickham); Wis. (Dane Co., W. S. Marshall).

Type.—In the Museum of Comparative Zoology, Cambridge, Mass.

***Haliphus vancouverensis*, new species.**

General color bright rufous. Length 4.5 mm. Head and antennæ bright rufous; head punctate; labrum strongly emarginate, rounded at the sides, a row of small setæ on its anterior margin.

Pronotum punctate, the punctures larger on the posterior portion, few and scattered on the disc. Prosternal ridge not margined, flat, strongly punctate, sharply declivous in front. Legs rufous; posterior coxae rounded behind, punctate, reaching the fourth segment of the abdomen. Abdominal segments shining, punctate along their posterior margins.

Elytra with ten rows of punctures of slightly darker color than elytra, the intervals with few small punctures; elytral margins faintly sinuate before the tip.

Described from one specimen from Vancouver Island, B. C.

Type.—In the collection of Professor H. F. Wickham, Iowa City, Iowa.

***Haliphus mimeticus*, sp. nov.**

General color rufous. Length 3.5 mm.

Head strongly and densely punctate except a small area on vertex; labrum emarginate, rounded at the sides.

Pronotum densely and strongly punctate, not so strongly on the disc; a semicircular depression across the disc, the hind margin convex posteriorly. Prosternal ridge strongly margined, densely punctate, convex longitudinally and laterally, the anterior margin squarely truncate and sharply declivous.

Abdominal segments shining, sparsely punctate. Posterior coxae punctate, attaining the fourth segment of the abdomen.

Elytra each with ten rows of large shallow punctures, intervals each with a definite row of small punctures; apices of elytra obliquely truncate (Plate V).

Described from one specimen (female) from the Pacific Slope.

Type.—In the Entomological Collection of Cornell University Ithaca, N. Y.

***Haliplus ruficollis* DeGeer.**

Dytiscus ruficollis DeGeer. Mémoires, IV, 1774, p. 404.

Dytiscus impressus Fabricius. Mant. Ins., I, 1787, p. 193.

Haliplus immaculicollis Harris. New England Farmer, VII, 1828, p. 164.

Haliplus americanus Aubé. Spécies des Col., VI, 1838, p. 26.

General color rufous to reddish-yellow with black spots and markings on elytra. Length 2.5-3 mm.

Head rufous, slightly infuscate behind; punctate; eyes broadly oval; labrum slightly emarginate, a row of setæ on its anterior margin; antennæ testaceous.

Thorax rufous; pronotum punctate, punctures of same color as pronotum, less densely punctate on sides and front; disc sparsely punctate; paired basal impressions present, never as long as one third the length of the pronotum; prosternal ridge grooved, convex longitudinally, steeply declivous in front; sides constricted in region of prothoracic legs, not widening anteriorly; abdominal segments smooth, shining, each except the last, with a series of punctures near posterior margin; last segment triangular in outline, punctate. Legs rufous; posterior coxae punctate, reaching the fourth segment of the abdomen.

Elytra with ten rows of punctures, the outer two rows of same color as elytra, the remainder black; intervals with irregularly placed punctures; black spots and margins distributed as shown in Plate XV. There is considerable variation in the arrangement and extent of the black markings. Apical margins of elytra rounded, not sinuate.

Habitat.—Common probably all over North America.

***Haliplus triopsis* Say.**

Haliplus triopsis Say. Trans. Amer. Phil. Soc. II, 1825, p. 106.

Haliplus pantherinus Aubé. Spécies des Col., VI, 1838, p. 29.

General color pale yellow to reddish-yellow with black markings on pronotum and elytra. Length 3.75-4.25 mm.

Head punctate except a small area on the middle of vertex; eyes circular in outline; labrum slightly emarginate, a row of setæ on the anterior margin, rounded at the sides; antennæ reddish-yellow to pale yellow.

Thorax pale yellow; pronotum with an oval black spot on its anterior

margin, strongly punctate except a linear transverse area on disc; paired basal impressions wanting. Prosternal ridge margined, convex transversely and longitudinally, sharply declivous in front, sides nearly straight, slightly constricted in the region of the prothoracic legs, punctate. Abdominal segments smooth and shining, punctate at their apices. Legs pale yellow; posterior coxae punctate, rounded posteriorly, reaching the fourth segment of the abdomen.

Elytra with large, well-defined black spots and margins (Plate XV). There is great variation in these markings, the spots on one elytron differing considerably from that of the other of the same insect. Each elytron has ten rows of large punctures of the same color as elytra; intervals, each with a fairly well-defined row of small punctures; apices of elytra obliquely truncate, slightly denticulate.

Habitat.—Maine and Ontario west to Wisconsin and Colorado, south to Georgia and New Mexico.

***Haliplus cribriarius* Leconte.**

Haliplus cribriarius Leconte. Lake Superior, Agassiz and Cabot, 1850, p. 212.

Color pale yellow with a black spot on head, one on pronotum, and several on the elytra. Length 4.75-5 mm.

Head punctate except a narrow transverse area in front of the black spot on vertex; a black crescent-shaped spot behind and between the eyes; eyes broadly oval in outline; labrum emarginate, rounded at the sides, a row of small setæ on the anterior margin; antennæ pale yellow.

Pronotum with a prominent black spot on its anterior margin, punctate, with two fairly well-defined rows of large, black, basal punctures, anterior row not reaching the margin, remaining punctures of the same color as the pronotum; disc sparsely punctate. Prosternal ridge not margined, flat transversely, convex longitudinally, strongly punctate, steeply declivous in front, sides constricted in the region of the prothoracic legs. Abdominal segments smooth and shining, fourth and fifth with a transverse series of punctures near the middle. Legs pale yellow to rufous; posterior coxae rounded behind, strongly punctate, reaching the fourth segment of the abdomen.

Elytra pale yellow with ten rows of large black punctures; intervals, each with a definite row of small punctures; black sutural stripe narrow, not extending beyond first row of small punctures; apical margins obliquely truncate.

Habitat.—Labrador (West St. Modest, one specimen); Newfoundland (Coast Plain, Bowditch; Bay of Islands, Leng); Canada (Nova Scotia); New Hampshire (Mt. Washington, Lakes of Clouds, Bowditch); New York (Ithaca); Ind. (Pine, Lake Co., Blatchley).

Type.—In the Museum of Comparative Zoology, Cambridge, Mass.

Haliplus nitens Leconte.

Haliplus ni ens Leconte. Lake Superior, Agassiz and Cabot, 1850, p. 212.

General color pale yellow with black markings on head, thorax and elytra. Length 3.75 mm.

Head pale straw color, a black spot on vertex, punctate except a small area just in front of the black spot; labrum slightly emarginate, rounded at sides, a row of small setæ on its anterior margin.

Pronotum with a small dark spot on its anterior margin; punctate, the punctures at the base larger and black, the others smaller and of the same color as the pronotum; disc sparsely punctate, with a transverse depression. Prosternal ridge not margined, almost flat, slightly convex transversely, convex longitudinally, strongly punctate. Abdominal segments smooth, shining; fourth and fifth, each with two irregular transverse rows of punctures near the middle; the last segment triangular in outline and punctate. Legs pale yellow; posterior coxae punctate, rounded behind, reaching the fourth segment of the abdomen.

Elytra pale yellow with indistinct black spots and markings small and distributed as shown in Plate V. Each with ten rows of shallow punctures, the outer row of the same color as the elytra, the others black; intervals, each with a row of small punctures; margins of elytra regularly rounded to tip, not sinuate.

This species has been placed by Crotch (1873) as a pale variety of *cibrarinus* Lec. From an examination of Leconte's types I feel confident that *nitens* is a good species, easily recognized by its smaller size, paler color and especially by the shallow and smaller punctures of the elytra and the transverse depression across disc of pronotum.

Habitat.—Michigan (St. Ignace, Leconte); Wis. (Bayfield).

Type.—In the Museum of Comparative Zoology, Cambridge, Mass.

Haliplus tumidus Leconte.

Haliplus tumidus Leconte. Trans. Amer. Ent. Soc., 1880, VIII, p. 166.

Broadly and acutely ovate, dull yellowish red, shining; prothorax punctured, more sparsely on the disc, more coarsely near the base. Elytra rapidly widened from the base for one fifth the length, then obliquely rounded and narrowed to the tip; (widest part fully one half wider than the base of the prothorax); striae composed of rather coarse punctures becoming smaller behind, interspaces each with a row of small distinct punctures; spots narrow, piceous, ill-defined, presenting the appearance of a sutural stripe, with two oblique interrupted branches and a marginal blotch near the tip. Prosternum coarsely punctured, perpendicularly declivous in front, deeply and broadly sulcate, strongly margined at the sides, slightly convex along the middle for the hinder half of its length; metasternum with a deep square impression, the sides of which are elevated, sparsely and coarsely punctured, coxal plates less coarsely punctured. Length 3 mm.

One specimen, Bosque Co., Texas; Belfrage. Easily known by the more ventricose form and peculiar sternal impressions; the prothoracic side pieces are sparsely punctured."

In order to make this paper complete I have copied here Leconte's description of this species.

Type. In the Museum of Comparative Zoology, Cambridge, Mass.

PELTODYTES Regimbart.

Peltodytes Regimbart, M. Ann. Soc. Ent. Fr. (5), VIII, 1878, p. 450.

Cnemidotus Erichson (non Illiger), Gen. Dyt., 1832, p. 48.

Type.—*Dytiscus cæsus* Duft.

Terminal segment of palpi conical, longer than the preceding. Palpi with numerous sensory pits. Submentum trilobed, the medium lobe not emarginate. Pronotum truncate, strongly narrowed in front, widest at base, convex above. Elytra with nine to ten rows of punctures, the punctures of the apical half usually much more irregular and more numerous. Intervals with few scattered punctures. Posterior coxae concealing all but the last segment of the abdomen. Hind tarsi somewhat shorter than the tibia; first tarsal joint longer than the fourth. Claws small.

Cnemidotus Illiger (1802) has been used for this genus but as has been pointed out by Regimbart (1878) it is an absolute synonym of *Haliplus* Latreille. Illiger (1802) in his genus *Cnemidotus* included only species which are congeneric with *Haliplus* Latreille (1802). Erichson (Gen. Dyt., 1832, p. 48) under Gen. 16 *Cnemidotus* Illiger cites *Dytiscus cæsus* Duft. *Dytiscus cæsus* Duft. is not congeneric with the species included in *Cnemidotus* by Illiger and Erichson's description of the genus does not apply to *Cnemidotus* in the sense of Illiger (= *Haliplus* Latreille).

Regimbart (Ann. Soc. Ent. Fr., 1878 p. 457) points out that *Cnemidotus* Erichson is not synonymous with *Cnemidotus* Illiger (= *Haliplus* Latreille) and proposes the name *Peltodytes* for *Cnemidotus* Erichson but failed to mention the included species. As Erichson mentioned only one species in his *Cnemidotus* namely *Dytiscus cæsus* Duft., this species must stand as the type of the genus *Peltodytes* Regimbart.

This genus contains twenty species, nine from North America, eight from Europe, two from the East Indies and one from Central Africa.

KEY TO THE SPECIES OF PELTODYTES.

- A.* Each elytron with a prominent tubercle.....*callosus* Leconte.
AA. Each elytron without such a tubercle.
B. Elytra each with nine rows of punctures.....*festivus* Wehncke.
BB. Elytra each with ten rows of punctures.
C. Femora of posterior legs entirely dark brown or rufous.
D. Apical margin of elytra sinuate truncate.....*simplex* Leconte.
DD. Apical margin of elytra not sinuate truncate, at most rounded or slightly sinuate.
E. Median spot of elytra broadly confluent with sutural stripe; punctures of posterior half of elytra not so deep and more irregular than basal half.
F. Species with very large black markings on elytra, almost crowding out the pale yellow ground color; a prominent irregular line of punctures between the first and second rows of punctures extending almost to the base....*floridensis* n. sp.
FF. Species not with such large black markings; no such prominent line of punctures between the first and second rows of punctures, only a few scattered ones present and these are behind the median black spot.....*muticus* Leconte.
EE. Median spot of elytra not broadly confluent with the sutural stripe, but rarely touching it; punctures of the posterior half of elytra not as in the foregoing.
pedunculatus Blatchley.
CC. Femora of posterior legs never entirely dark brown or rufous.
G. Posterior femora ringed with yellow at distal ends.
H. Vertex immaculate*duodecimpunctatus* Say.
HH. Vertex with a prominent black spot.....*edentulus* Leconte.
GG. Posterior femora entirely yellow.....*litoralis* n. sp.

Peltodytes callosus Leconte.

Cnemidotus callosus Leconte. Ann. Lye. Nat. Hist., V, 1852, p. 201.

General color pale yellow with black markings on pronotum and elytra. Length 3.5 mm.

Head punctate, the vertex brownish black to black; labrum not emarginate; eyes nearly circular in outline; antennæ testaceous.

Pronotum with two black basal spots, punctate, the disc sparsely so; punctures of the same color as pronotum except those between the basal black spots which are sometimes black. Prosternal ridge margined, strongly constricted in the region of the prothoracic legs, widening anteriorly, grooved at point of constriction, strongly convex longitudinally, sharply declivous in front. Posterior coxae punctate, reaching the last segment of the abdomen; the last abdominal segment triangular in outline and impunctate.

Each elytron with a prominent tubercle or elevation at the place of the anterior black spot; with ten rows of black punctures; an irregular row of large punctures between the third and fourth rows; intervals with a few scattered punctures; the punctures behind the tubercle smaller, more numerous and not arranged in such definite rows. Apices of elytra rounded not sinuate.

Habitat.—Cal. (San Francisco, Pomona, Hills back of Oakland, E. C. Van Dyke; San Diego, Leconte); New Mexico (Albuquerque).

Type.—In the Museum of Comparative Zoology, Cambridge, Mass.

Peltodytes simplex Leconte.

Cnemidotus simplex Leconte. Ann. Lyc. Nat. Hist., V, 1852, p. 201.

General color rufous with black spots on elytra and pronotum. Length 3.5 mm.

Head rufous; punctate; labrum not emarginate, anterior margin with a row of setæ, rounded at the sides; antennæ rufous.

Thorax rufous; pronotum with two basal black spots, punctate, the disc sparsely so; punctures of the same color as the pronotum. Prosternal ridge flat, not grooved, slightly constricted in the region of the prothoracic legs, widening anteriorly, steeply declivous in front. Posterior coxae punctate, reaching the last abdominal segment. Last segment of abdomen triangular in outline, impunctate.

Elytra each with ten rows of black punctures; an irregular interrupted row of large punctures between the third and fourth rows; punctures not so irregularly placed on the apical half as in *callosus* Lec.; intervals with but few punctures; apical margins sinuate-truncate.

Habitat.—California (San Diego, Leconte; Guerneville, Hills back of Oakland, E. C. Van Dyke).

Type.—In the Museum of Comparative Zoology, Cambridge, Mass.

Peltodytes edentulus Leconte.

Cnemidotus edentulus Leconte. New Species of N. A. Col., I, 1863, p. 21.

General color pale yellow with black markings on head, thorax and elytra. Length 3.5-4 mm.

Head testaceous with a large crescent-shaped black spot on vertex between the eyes; punctate except a small area on vertex in front of the black spot; labrum not emarginate, a row of small setæ on anterior margin; antennæ testaceous; eyes nearly circular in outline.

Pronotum with a pair of black basal spots; punctate; punctures on sides and front smaller than on the base: disc sparsely punctate; punctures of same color as pronotum. Prosternal ridge margined, punctate, sides constricted in region of prothoracic legs, widening anteriorly, sharply declivous in front. Legs pale yellow except femora of posterior legs which are brown or black ringed with yellow at their distal ends. Posterior coxae reaching the last segment of abdomen, punctate, not or only very slightly angulate on their

posterior margins; last abdominal segment triangular in outline, sparsely punctate.

Elytra with ten rows of punctures, the anterior part of outer two rows of same color as elytra, the others black; between the third and fourth rows is a partial row interrupted by the anterior black spot; apical margins sinuate-truncate.

Habitat.—Ont.; Mass. (Amherst); New York (Ithaca, Golden, Pike); Mich. (Lansing); Indiana (Lake Laporte, Marshall and Fountain Cos., Blatchley, 1910); Ill. (Lake Forest, J. G. Needham, Beach, Ill.); Iowa (Iowa City, H. F. Wickham); Wis. (Dane Co., H. F. Wickham and Wm. S. Marshall); Kansas (Leconte).

Type.—In the Museum of Comparative Zoology, Cambridge, Mass.

Peltodytes duodecimpunctatus Say.

Cnemidotus duodecimpunctatus Say. Trans. Amer. Phil. Soc., II, 1825, p. 106.

General color pale yellow to reddish-yellow with black markings on pronotum and elytra. Length 3.5-4 mm.

Head punctate; labrum not emarginate; a row of setæ on its anterior margin; antennæ testaceous.

Pronotum with two basal black spots, punctate; punctures of same color as pronotum; punctures of front and sides smaller than those of base. Prosternal ridge margined, grooved; constricted in the region of the prothoracic legs, widening anteriorly, punctate, steeply declivous in front. Posterior coxae angulate on hind margin; punctate; reaching the last segment of abdomen. Last abdominal segment triangular in outline, impunctate except on apical margin.

Legs pale yellow except the femora of the hind legs which are dark brown ringed with yellow at their distal ends.

Elytra, each with ten rows of punctures; intervals with a few scattered punctures; black spots and margins arranged as shown in Plate V. Apical margins of elytra strongly sinuate-truncate.

Habitat.—Canada (Ont. & Que., H. F. Wickham); New York (Poughkeepsie, Flushing, L. I., Ithaca); Indiana (Blatchley, 1910); Ill. (Lake Forest, J. G. Needham); Wis. (Dane Co., Wm. S. Marshall); Pa. (South Western, Hamilton, 1895); Kentucky.

Peltodytes pedunculatus Blatchley.

Cnemidotus pedunculatus Blatchley. Coleoptera of Indiana, 1910, p. 204.

General color pale yellow with black spots on pronotum and markings on elytra. Length 3.5 mm.

Head closely and finely punctate; labrum not emarginate, a row of fine setæ along its anterior margin, rounded at sides; antennæ pale yellow; eyes nearly circular in outline.

Pronotum with two basal black spots, punctate; punctures of base larger than those of sides or front. Prosternal ridge margined, not grooved, nearly flat, punctate, sides slightly constricted in region of prothoracic legs, widening anteriorly, steeply declivous in front. Legs pale yellow except femora of hind legs which are black; posterior coxae attaining the last segment of abdomen. Last segment of abdomen triangular in outline, impunctate.

Elytra, each with ten rows of black punctures; an irregular, interrupted row of large punctures between the third and fourth rows; spots, stripes, and punctures arranged as shown in Plate V; punctures of apical half of elytra smaller, irregularly arranged but not so numerous as in *muticus* Lec.; apical margins sinuate-truncate.

This species is closely related to *muticus* Lec. and it may prove only a variety when the distribution of the species is more fully known.

Habitat.—New York (Ithaca); Mich. (Lansing); Ind. (Laporte; Marshall, Fountain, Marion and Laurence Co's. Blatchley, 1910); Ga. (Spring Creek, Decatur Co., J. C. Bradley); La. (Covington, H. F. Wickham); Texas (Brownsville, H. F. Wickham).

Peltodytes muticus Leconte.

Cnemidotus muticus Leconte. New Species N. A. Col. I, 1863, p. 21.

General color pale yellow, rarely reddish-yellow with black markings on pronotum and elytra. Length 3.5–4 mm.

Head punctate; labrum not emarginate, a row of setæ on its anterior margin; eyes broadly oval; antennæ testaceous.

Pronotum with a pair of basal black spots, punctate, the disc sparsely punctate; punctures of the same color as the pronotum except the few which are between the basal black spots which are black. Prosternal ridge flat, margined, sharply declivous in front, sides constricted in the region of prothoracic legs, widening anteriorly. Posterior coxae punctate, reaching the last abdominal segment; hind femora reddish-brown, not ringed with yellow. Last abdominal segment triangular in outline, impunctate.

Elytra each with ten rows of black punctures; an irregular, interrupted row of black punctures between the third and fourth rows; intervals with a few scattered, small punctures; black markings arranged as shown in Plate XV; median black spot broadly confluent with the sutural stripe; apical margins rounded, not sinuate-truncate.

Habitat.—Canada (Ont. and Que., H. F. Wickham); Mass. (Amherst); R. I. (Providence); New York (Ithaca, Golden, Flushing, L. I.); Pa. (Phila. Neck); Ga. (Offerman, Thelma, J. C. Bradley); Florida; Indiana (Common, Blatchley, 1910).

Type.—In the Museum of Comparative Zoology, Cambridge, Mass.

Peltodytes festivus Wehncke.

Cnemidotus festivus Wehncke. Stett. Ent. Zeitg., 38, 1876, p. 356.

Rotundatus, brevis, pallide testaceus, prothorace sparsim punctato, basi utrinque foveolato, clytris-striatus, interstitiis rugoso-punctatis, basi, sutura et maeulis 14 piccis. Long 2.75 mm.

A beautiful, bright yellow species, near to *P. duodecim-punctatus* Say. It is about one half smaller, of more rounded form and distinguished by two depressions, one situated on each side of the base of the pronotum.

The head is small and possesses moderately large projecting eyes. The space between the ocelli is finely punctate. The pronotum is short, widest at the middle, strongly and densely punctate at the sides; at the base there is found on each side a deep pit formed by a large puncture.

The elytra are gradually rounded to the tip, finely and rugosely punctate; nine rows of punctures present, the punctures largest at the base, becoming smaller towards the tip. The base, the tip, a common spot at the tip, as well as seven spots (one behind the shoulder at the side, another before the middle, two behind this and three at the tip forming a triangle) dark brown.

Underside and legs with the exception of the brownish posterior coxae, yellow.

Habitat.—Texas.

As I have not seen any specimens of this species I here reproduce the original description translated for the benefit of future workers.

Peltodytes floridensis new species.

General color pale yellow to rufous with black markings on pronotum and elytra. Length 3.5 mm.

Head finely punctate; labrum not emarginate, rounded at sides, a row of small setae on anterior margin; eyes prominent; antennæ testaceous to rufous.

Pronotum pale yellow to rufous with two basal, black spots, punctate, the punctures larger at base than at front or sides; disc with few scattered small punctures. Prosternal ridge margined, punctate, nearly flat from side to side, convex longitudinally, sharply declivous in front. Posterior coxae large, extending to the last abdominal segment, slightly angulate on the posterior margin; femora of posterior legs entirely rufous to black, not ringed with yellow.

Elytra with ten rows of black punctures; an irregular row between the first and second rows extending to near the base of elytra; many large, irregularly placed punctures between third and fourth rows; the remaining intervals with scattered punctures; punctures smaller and more irregular on apical half of elytra; sutural black stripe in front of median black spot extending to first row of punctures; apical margins obliquely truncate to rounded.

This species is closely related to *muticus* Lec. but differs in the points mentioned above. It is a darker, southern form and may prove

to be connected with *muticus* Lec. and this again with *pedunculatus* Blatchley.

Described from four specimens from Sanford, Florida. From the collection of Prof. William Marshall, Madison, Wis.

Habitat.—Florida.

Type.—In the Entomological Collection of Cornell University, Ithaca, N. Y. Paratypes in the collection of Prof. W. S. Marshall, Madison, Wis.

Peltodytes litoralis new species.

General color pale yellow to reddish yellow with black markings on elytra and prothorax. Length 3.5 mm.

Head pale yellow, punctate except on vertex; eyes large, protruding, strongly convex, circular in outline; labrum scarcely emarginate, a row of small setæ along anterior margin, rounded at the sides; antennæ pale yellow.

Pronotum pale yellow with two basal black spots, punctate, the punctures smaller on front and sides; disc sparsely punctate. Prosternal ridge strongly margined, grooved, sparsely punctate, steeply declivous in front. Legs pale yellow to rufous; posterior coxae punctate, subangulate on their hind margins, reaching the last segment of the abdomen.

Each elytron with ten rows of punctures, the anterior part of the outer two rows of the same color as the elytra, the others black; the rows 1, 2, 8, 9, and 10 of small punctures, the other rows of much larger punctures; an interrupted row of black punctures between the third and fourth rows.

Described from 5 specimens.

Habitat.—Texas (Dallas); Kansas (Douglas Co., 900 ft. elevation).

Type.—In the entomological collection of Cornell University, Ithaca, N. Y. Paratype in the collection of the Michigan Agricultural College, East Lansing, Mich.

THE NATURAL HISTORY OF THE HALIPLIDÆ.

Very little has been written regarding the habits, ecology, etc., of the adult Haliplidæ. Schiodte ('61-'72) has given us rather extensive and detailed descriptions of the larvae and pupæ of several species. This small family of aquatic beetles has been neglected although the commoner species are widely distributed, often very abundant, and easily collected. The genera, *Haliplus* and *Peltodytes*, occur almost everywhere in small pools, particularly those that are spring feed and contain filamentous algae and other aquatic plants.

They prefer shallow pools although wherever there are sufficient growths of *Nitella* or *Chara* they may be found in the deeper parts. In amongst the aquatic plants near the shores they may be found, often very abundant and a single sweep of a small water-net may bring up a dozen or so. It may also be noted that these beetles are not found abundantly in all small pools but only here and there one meets with them as one of the more dominant forms. I have found them most abundant in spring fed pools which do not dry up during the summer. In such pools some of the species are very abundant. In a single pool I have taken the following species, listed according to their relative abundance: *H. ruficollis* DeG., *H. connexus* Matheson, *P. edentulus* Lec., *P. muticus* Lec., *H. triopsis* Say, *H. cibrarius* Lec.

The adult Haliplids are poor swimmers and are never found in the open water except when forced there. They live amongst the plants bordering the shores and occupying the shallow waters. Here they are found clinging to the stems of aquatic plants, swimming short distances, or walking over the algae on which some species feed. They swim by means of their legs, which are furnished with long fringes of hairs. The tarsi of all the legs and the tibia of the first and second pairs are provided with these fringes (Figs. 13, 14, 15). The fringes are long and supported by short, stiff setæ (Fig. 14). The hind legs are the chief organs of locomotion and in swimming move backwards with a slightly downward sweep. This is brought about by the limiting action of the coxal plates which overlap the first three to five abdominal segments (Figs. 11, 12). The hind legs move alternately in swimming and so far as I can determine, all the legs move in the same manner as they do in walking. They swim but slowly. On land they walk or run with considerable ease and agility, raising the body clear from the surface and placing the weight on the tarsi of all the legs. I have never found these beetles at electric lights nor have I seen them use their wings in flight, though they probably do fly.

Their method of respiration is rather unique and nothing like it has been described so far as I know. The elytra are firmly held in place not only by the groovings in the pleura but also by the knoblike structures on the anterior outer ends of the posterior coxae (Fig. 12). These knob-like structures fit closely into socket-like de-

pressions of the elytra (Figs 11 and 12). At first I was led to suppose that these insects secured their air supply as in the Dytiscidae, by breaking the surface film with the tip of the abdomen and carrying an air supply under the elytra. I was led to this belief from seeing many of them with an air bubble attached to the posterior end of the body. But as the elytra are rather firmly held in place by the knob-like structures it seemed doubtful if these beetles could open the tips of the elytra and not at the same time allow the entrance of water.

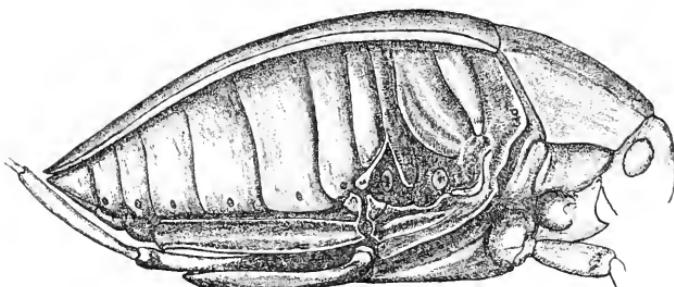


FIG. A. Lateral view of *H. triopsis* with wing cover removed to show method of respiration.

However on close observation it was soon seen that the air supply was carried under the broad coxal plates, at the posterior end of which an air bubble is usually found. As the femora move back and forth through this air supply I could not quite determine how the air reached the spiracles. On examining beetles from which the elytra were removed it was soon seen how the air supply became available. In text figure (Fig. A) a beetle is shown in side view with one elytron removed. Leading from the anterior end of the posterior coxa is seen a narrow groove in the pleurum. This widens at first, then narrows and finally divides into two branches. One branch passes backwards and opens directly near the second abdominal spiracle. This air supply reaches all the abdominal spiracles. The other branch passes forward and conveys an air supply into a large depression in which are located the first abdominal and meta-thoracic spiracles. These spiracles are much enlarged. The first abdominal spiracle is very large, oval in outline and is almost closed by long, fine setæ. This condition of the enlargement of the first abdominal spiracles is in marked contrast to that found in the Dytiscidae. The meso-

thoracic spiracle is small and probably functions to some extent as air can reach it. Thus these beetles carry their air supply under the elytra but obtain it by way of the coxal plates and lateral grooves leading under the elytra. These grooves are lined with fine short setæ, all pointing towards the entrance and prevent the ingress of water.

Structural Adaptations.—The Haliplidæ are undoubtedly closely related to the Carabidæ on the one hand and to the Dytiscidæ on the other. Whether they can be considered as a transition group is a question I do not care to discuss at this point. The adaptations of the diving beetles have been well discussed by Needham and Williamson (1907). The same kinds of adaptations there pointed out are found in this family though not carried to such perfection of development. The demands for aquatic life are: (1) Rigidity of structure. (2) Diminished resistance. (3) Efficiency in swimming. The rigidity of bodily form is brought about by the close fitting and adjusting of the parts of the external skeleton. As in the Dytiscidæ the head fits closely into the prothorax, the parts of the thorax are quite solidly joined together, and the elytra are closely applied to the sides of the body and to each other on the mid-dorsal line.

The close-fitting of the head into the prothorax has been brought about not by the flattening of the head as in the Dytiscidæ but by the development of the prosternum to form a deep ridge into which the head fits (Fig. 12). The prosternum is firmly fused and almost completely conceals the mesosternum. The metasternum is prolonged forward between the middle coxae and fits firmly into a socket-like depression in the prosternum (Fig. 11). The elytra fit closely to the sides of the body and their bases meet the sinuate margin of the pronotum closely and firmly, making a water-tight and smooth junction. The scutellum is wanting. Posteriorly the elytra are held in place by the knob-like prolongations of the posterior coxae (Fig. 12). This kind of an adaptation is, so far as I know, not met with in any other of the families of the Coleoptera.

The necessity for a diminished resistance has been met to some extent and along the same lines as in the Dytiscidæ. The antennæ are filiform, reversed, and each lies in a small groove directly below the eye; the eyes are not so prominent as in the Carabidæ; the contours of the body are rounded; and there is a lessening of sculpturing

and a partial loss of hair. The shape of the body is also deeper and narrower than in the Dytiscidæ, a form better fitted for movement through the water, but lacking the means of rapid propulsion.

The swimming efficiency is very feeble as compared with the more specialized Dytiscidæ. Instead of a soldering fast of the posterior coxie and the formation of a solid joint, as in the Dytiscidæ, there is a remarkable plate-like development of the coxae. By this means the hind legs are moved in one plane and their efficiency as swimming organs increased though their horizontal range of movement is, if anything, lessened. There is also a developmenut of long fringes of hairs on the tarsi of all the legs and the tibia of the first and second pairs. These fringes are in some measure supported by short, stiff setæ (Fig. 14). There is no shortening of the proximal joints of the legs, nor the lengthening or flattening of the tarsi as in the Dytiscidæ.

The modifications for the securing and storage of an air supply have already been fully discussed.

Feeding Habits.—Little is known regarding the feeding habits of many of the adult aquatic Coleoptera. In most cases it is taken for granted that they are carnivorous. Unfortunately I have not much information regarding the adult Haliplidæ. In my aquaria *H. ruficollis*, *H. connexus*, and *H. cibrarius* were observed feeding greedily on the contents of *Nitella*, the softer portions of *Chara* and other filamentous algae. They crush open the *Nitella* stems with their mandibles and devour the contents, leaving the cell wall. *H. cibrarius* was especially greedy and a dozen or so would destroy considerable quantities of *Nitella* in a very short time. Whether they feed on animal matter or not I am not prepared to say, though I have observed them destroying dead specimens of their own kin in my aquaria. This may have been due to the lack of sufficient vegetable food. For in the case of *H. cibrarius* and *H. connexus* it was found that when freshly placed in aquaria with *Nitella*, they greedily attacked the young and tender tips. *H. ruficollis* also fed readily on the smaller filamentous algae and *Nitella*.

Egg-laying Habits.—Nothing has been written regarding the eggs or egg-lying habits of any species belonging to this family. During the past two years I reared two species of *Peltodytes* and one of *Haliphus*. In the genus *Peltodytes* the eggs are fastened to the strands of filamentous algae, particularly *Nitella* and *Chara*, while in *Haliphus*

(*H. ruficollis*) the eggs are deposited within the dead stems of *Nitella*. I shall describe separately the life-history of each species studied.

Peltodytes muticus Lec.

The Egg.—Brownish in color, broadly oval, with faint roughened markings, a small knob on the anterior end. Length .466 mm.; width .254 mm. The eggs are attached to the stems of aquatic plants, particularly *Nitella* and *Chara* (Fig. 33). Mating takes place in the water during the early part of spring, the latter part of April and May, and egg-laying begins a short time later. The average time for the hatching of the eggs is about two weeks, varying of course according to the weather conditions. From eggs laid on May 9, 1910, the first larvæ appeared on May 24. The larvæ break their way out by a longitudinal split through the anterior end of the egg.

First Instar.—Length including the caudal setæ, 2 mm.; caudal setæ .6 mm. Head prominent. Eyes, each of six ocelli arranged in two vertical rows on a prominent chitinous projection on the lateral aspect of the head. Antennæ 2-segmented, with a terminal spine, the proximal segment the longer. Thorax consists of three segments, abdomen of nine. Each segment except the last, provided with four long, jointed spines, two dorsal and two lateral. The prothoracic segment has four small, unjointed spines on its anterior margin. The last abdominal segment possesses two long caudal setæ. The caudal setæ are two-jointed, the second segment short and fine. The dorsal and lateral setæ are two-jointed, the second joint long and slender. The mesothoracic dorsal spines are .6 mm. long, the first joint .2 mm. The other spines average about the same length. The legs except the first pair are long and fitted for walking over filamentous algæ. The first pair are short and modified into grasping organs. The structure of the legs will be fully discussed later. Spiracles are absent.

Second Instar.—The first molt takes place about six days after hatching. Not much change is to be noted except increase in size and in the length and number of the joints of the spines covering the body. Length 3.6 mm. (including the caudal spines); caudal spines 1.5 mm. The antennæ are now three jointed with a terminal spine. The first joint is very short and inconspicuous. Each segment except the penultimate is furnished with spines as described for

the first instar only they are much longer and each one consists of many more joints. The penultimate segment now possesses only the dorsal spines and the basal joint of each of the lateral spines. The mesothoracic dorsal spines are now over 2 mm. in length and 9-jointed. The other spines are about the same length and also 9-jointed. At the side of the proximal joint of each spine is a short, stout, lateral spine. This spine is longer than the thickness of the large spine while in *P. edentulus* Lec. it is shorter (Figs. 28, 29). This serves as a good separating character from the second stadium to the end of the larval life. Spiracles are wanting. The second stadium occupies on the average, about nine days.

Third Instar. The Mature Larva.—The second molt occurs eight to ten days after the first. The larva is now in its last stage. This stage lasts from seven to ten days, dependent largely upon the food supply. Length, excluding the caudal setæ, 6 mm., caudal setæ 4 mm. Antennæ are now 4-jointed with a terminal spine. The last segment consists of two closely united pieces, placed side by side (Fig. 26). Ocelli six, placed on a prominent lateral elevation. The larva consists of twelve segments. Each segment except the first and the penultimate with the spines arranged as in the preceding instar. The prethoracic segment now has six jointed spines, two lateral and four dorsal (Fig. 34). The extra two spines develop during the second stadium and appear at the time of the molt. These two extra spines are smaller and fewer jointed (11-jointed). The mesothoracic spines are 18-jointed and 4 mm. long. It is rather difficult to be certain regarding the number of segments in these long, delicate spines as they break off very easily. The other spines range about the same length with varying number of segments. The penultimate segment has two dorsal spines and only the reduced basal segment of the lateral spines. Spiracles are wanting.

The mouth parts and legs are practically identical with those of *P. edentulus*. These are described in detail further on.

Pupation.—When mature the larvae leave the water in search of a place in damp soil to pupate. They begin entering the soil about a week to ten days after the second molt. Here they hollow out a small cavity within which they transform (Fig. 37). The prepupal period lasts about a week to ten days.

Pupa.—Length 3.5 mm. entirely white (Fig. 38) and remains so

except for the eyes, till the time of the emergence of the adult. The head lies curved under the prothorax and between the developing forelegs, smooth except for two setæ placed between the eyes. Pro-

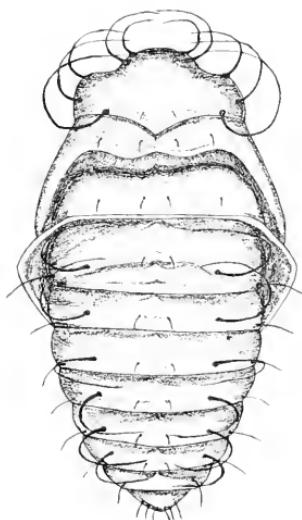


FIG. B. Pupa of *P. edentulus*, dorsal view.

notum with ten long, curved, unjointed spines, four on the anterior, two on each lateral and two on the posterior, margins. These spines prevent the anterior end of the pupa from touching the soil in its pupal chamber. Abdomen of eight segments, each bearing on its dorsal surface four long, unjointed spines, two lateral and two dorsal. Between the dorsal spines are two shorter, small spines present on each segment except the last two. These long, curving spines prevent the delicate abdomen from touching the soil. Ventral surface of abdomen smooth. The pupa lies on its back in its pupal chamber and the spines just described support and protect it from contact with the soil. The caudal end of the pupa is also provided with a few short spines. There are two thoracic and seven abdominal spiracles present.

Adult.—The pupa changes to the adult about two weeks after pupation. The adult is at first perfectly soft and colorless except for the pigmented eyes. It requires several days before the adult beetle has attained its full color and is ready to leave the pupal chamber. In

my rearings the adults emerged on July 5, 1910, just seven weeks after the eggs were laid. Unfortunately I had to stop my work at this time and no further rearings have been made.

Peltodytes edentulus Lec.

The Egg.—Brownish in color, broadly oval, with roughened markings, a small knob on the anterior end. Length .466 mm.; width .233 mm. The eggs are attached to the stems of aquatic plants, particularly *Nitella* and *Chara* (Fig. 33).

It will be unnecessary to discuss the time of hatching, the different instars, or the number of stadia as they are identical with those of *P. muticus* Lec. It will be necessary only to point out the differences between the mature larvæ of the two species.

Mature Larvæ.—Length, excluding the caudal setæ, 6 mm.; caudal setæ, 4 mm. The dorsal and lateral spines are arranged similarly to those in *P. muticus*. Not the slightest difference can be observed. The only point of distinction between the mature larvæ of these two closely related species is in the relative lengths of the short spines present on the proximal segment of each dorsal spine. In *P. muticus* the lateral spine is longer than the thickness of the large spine while in *P. edentulus* it is shorter (Figs. 28, 29.) Spirals are absent.

Pupation.—The time of pupation, the pupal chamber, the length of the prepupal and pupal life are identical with that found in *P. muticus*. So far as I can discover there are absolutely no differences between the pupæ of the two species.

Haliplus ruficollis DeG.

This is the only species of the genus that I have succeeded in rearing and of this species I have not yet been successful in securing pupæ. In 1910 many larvæ died in trying to find suitable places in which to pupate and I had to give up the work before I could secure the necessary conditions for pupation in this species.

As with the species of *Peltodytes* mating takes place in the water. I found them freely copulating in spring-fed pools on May 9, 1910. Several pairs in copula were placed in aquaria with abundance of algae, particularly *Nitella*. On May 16 I found eggs placed within the dead, hollow cells of *Nitella*. The female cuts an opening with her mandibles and then deposits several eggs within the cell through this hole (Fig. 32). This is continued till quite a large number of eggs are laid.

The Egg.—The egg is pure white in color, oval. Length .365 mm.; width .22 mm. In my aquaria these eggs hatched in ten to twelve days after oviposition.

First Instar.—Length including caudal setæ, 2.5 mm.; caudal setæ .4 mm. The larva consists of thirteen segments, exclusive of the head. Each segment, except the last, with several two-jointed spines. The last segment is prolonged into two long spines, each terminating in a short seta. This stage occupies about nine days.

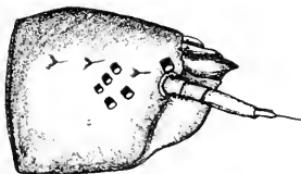


FIG. C. Lateral view of head of larva of *H. ruficollis*.

Second Instar.—Owing to the small number of larvae in my aquaria I did not reserve any specimens of this instar for detailed description. This stage lasts from eleven to twelve days.

Third Instar. The Mature Larva (Fig. 36).—Length, including the anal appendages, 9 mm. The head is strongly chitinized, somewhat depressed. Ocelli, six, arranged as shown in figure C. Antennæ four-jointed, with a short terminal spine. The last segment consists of two closely approximated pieces.

Excluding the head the larva consists of three thoracic and ten abdominal segments. The legs, except the first pair, are fitted for walking. The last abdominal segment is prolonged, ending in two unjointed spines. Each spine ends in a single long seta. Length of last segment, exclusive of spines, 1.2 mm., spines, .38 mm. Each segment, except the last, with two dorsal chitinous plates. These plates meet on the mid-dorsal line. Those of the eighth and ninth abdominal segment are each fused into one. These plates are closely set with many, short, stout spines. The ventral surface of each segment is more or less chitinized and provided with numerous short, stout spines.

Spiracles are present on the meso- and meta-thoracic and the first seven abdominal segments. The spiracles are located in the pleura between the lateral and ventral chitinous areas of each segment.

This stage lasts from five to seven days before the larvae begin entering the soil to pupate. In my aquaria the second molt occurred on June 15 and the larvae began entering the soil on June 20. Unfortunately none of these larvae had pupated when I had to give up the study for other work which called me away.

The Larval Mouth Parts.—The mouth parts of *P. edentulus* and *P. muticus* are practically identical. I shall describe the mouth parts of *P. edentulus*.

The mandibles are rather powerful chitinized structures. Each ends in a sharp hollow projection (Fig. 20). On the inner face just below the projection is a prominent tooth-like elevation. Each mandible is pierced by a hollow, cylindrical tube opening into the mouth at the base and at its tip in the hollow projection. The tube gradually widens towards its proximal end. In Figs. 20, 21, the hollow tubes are shown in dotted lines. Powerful muscles are attached to the inner face of each mandible. Each mandible bears five long setæ on its outer edge.

The maxillæ are rather complicated structures (Fig. 23). Each consists of a basal segment and a large distal one bearing a two-jointed palpus and a chitinous projection on its inner face. This projection bears many small setæ. Setæ are found scattered over the maxillæ. The labium consists of a submentum and a mentum bearing a single jointed palpus (Fig. 23).

The mouth parts of *H. ruficollis* are well figured and described by Schiodte in his *De Metamorphosi Eleutherorum*, Vol. I, p. 72, Plate VIII, Figs. 5, 6, and 7.

The Larval Legs.—The larval legs with the exception of the first pair, are practically identical in the two genera studied. The first pair are fitted for grasping and are held forward and closely applied to the lower surface of the head. The other two pairs are long and slender, well fitted for walking over filamentous algae. Each leg consists of five segments and a single claw (Fig. 27). The claw bears a short basal spine. The prothoracic legs are remarkably adapted for grasping. In *H. ruficollis* the penultimate segment is prolonged on its inner side and bears two large lateral and apical spines (Fig. 24). Against this prolongation fits the last segment while the claw falls between the last pair of spines. In *P. edentulus* and *P. muticus* the prolongation bears, besides the spines, a series of sharp serrations

while the terminal claw bears a few setæ (Fig. 25). This makes an ideal arrangement for grasping and holding filamentous algae.

Feeding Habits of the Larvæ.—Although Schiodte has given us much detailed information regarding the structural characters of these larvæ he made no observations on their habits. His detailed studies on the larval mouth parts led many to conclude that they are carnivorous. What was my surprise when I found what had always been considered carnivorous species eagerly devouring the algae amongst which they were living! My chief fear in attempting to rear these larvæ was the securing of a food supply. However, this difficulty was quickly removed when I found the larvæ eagerly devouring filamentous algae. I have previously described the remarkable modifications of the first pair of legs. I have also described the sharply curved mandibles each pierced by a small tube, similar to that found in the larvæ of the Dytiscidae. These larvæ feed exclusively on filamentous algæ, *Spirogyra*, *Zygenma*, *Mucocotia*, etc. It is a remarkable sight to see one of the long spined larvæ of *Peltodytes* eagerly grasp a strand of algæ and by means of its forelegs push it backwards like a sailor hand over hand until it reaches a broken end. Then by puncturing the cell wall with its sharp mandibles the larva sucks the contents into its mouth. By means of a hand lens or low power of the microscope one can easily observe the chloroplasts pass through the hollow mandibles. The front legs are used to hold and push the filament forward as fast as the contents are removed by the mandibles. When the larva finishes the strand it will again pass the alga backwards hand over hand or rather foot over foot, while the mandibles secure any of the contents not previously obtained.

I did not observe any of the larvæ studied to attack any living form, though numerous small Entomostraca were constantly present in my aquaria.

Adaptations of the Larvæ.—The adaptations of these larvæ to their aquatic environment are found in the structure of the mouth parts, the legs, and the manner of securing an air supply. The mouth parts in conjunction with the prothoracic legs seem to be especially fitted for the obtaining and handling a food supply. The meso- and metathoracic legs seem to be particularly adapted for walking over filamentous algæ. They are long and terminate in a single claw which bears a short, fine, basal spine. But the most remarkable adaptation

is found in the way the larvae of *Peltodytes* secure an air supply. In *Haliphus* there are present two thoracic and seven abdominal spiracles. In *Peltodytes* no spiracles are to be found till the pupal stage is reached. The larvae as pointed out possess many, long, jointed spines. As shown by Schiodte these spines contain tracheæ which undoubtedly function for the securing of an air supply from the oxygen dissolved in the water. Fig. 30 shows a part of a segment containing a large trachea (each spine contains but a single large trachea) with numerous tracheoles arising from it. Fig. 31 shows the termination of a trachea in three tracheoles. It is by means of these tracheated spines that the larvae of *Peltodytes* secure an air supply.

In conclusion I wish to thank Professors A. D. MacGillivray and J. Chester Bradley for criticism and advice in the preparation of the systematic part of this paper and Professor J. G. Needham for his aid in the working out of the life-histories.

SUMMARY.

The adults.—(1) The commoner species of *Haliphus* and *Peltodytes* are widely distributed and are at times locally abundant in spring fed pools.

(2) They feed almost exclusively on filamentous algæ, particularly *Nitella* and *Chara*.

(3) They are poor swimmers, the hind legs being the chief organs of locomotion. The legs are furnished with fringes of long hairs.

(4) They secure their air supply by way of the posterior coxal plates and the grooves in the pleura. The metathoracic and first abdominal spiracles are enlarged.

(5) Mating begins in the early spring and the eggs are deposited during the latter part of April, May and June. The species of *Peltodytes* attach their eggs to aquatic plants mainly *Nitella* and *Chara*, while *Haliphus* (*H. ruficollis*) places its eggs within the dead cells of *Nitella*.

The Larvæ.—(6) The larvæ have only three instars (two molts). They apparently feed exclusively on filamentous algæ (conjugatæ).

(7) The larval mouth-parts are adapted for feeding on algæ. The first pair of legs are modified into organs for grasping and handling algal filaments.

(8) In *Haliplus* the air supply is probably obtained through the two thoracic and seven abdominal spiracles. In *Peltodytes* there are no spiracles and the air supply is obtained by means of numerous, long, jointed, tracheated spines.

(9) The larval life lasts but a short time (three to four weeks). Pupation takes place in the soil in a small earthen chamber. The pupal life lasts about three weeks.

(10) There is probably more than one brood a season.

BIBLIOGRAPHY.

- AUBÉ, CHARLES (1838). Species générales des Coléoptères de la collection de M. le Comte Dejean, Tome VI, pp. 2-39.
- BRANDEN, C. VAN DEN (1884). Catalogues des Coléoptères Carnassiers Aquatiques. *Ann. Soc. Ent. Fr.*, XXIX, pp. 7-12.
- BLATCHLEY, W. S. (1910). Coleoptera or Beetles of Indiana. Bull. I. Dept. Geology and Natural Resources, pp. 200-204.
- ERICHSON, W. F. (1832). Genera Dyticeorum. Dissert. Inaug. Berlin, Hold., pp. 46-48.
- FALL, H. C. (1901). List of the Coleoptera of Southern California with Notes on the Habits and Distribution and Descriptions of New Species. Occasional papers of the California Academy of Sciences, Vol. VIII, pp. 51-52.
- GANGLBÄUER, L. Die Käfer von Mitteleuropa. Erster Band, pp. 422-433.
- GEMMINGER AND HAROLD (1868). Catalogus Coleopterorum, II, pp. 425-427.
- NEEDHAM, J. G. AND WILLIAMSON, HELEN V. (1907). Observations on the Natural History of the Diving Beetles. *Amer. Nat.*, XLI, pp. 477-494.
- RÉGIMBART, M. (1878). Étude sur la classification des Dytiscides. *Ann. Soc. Ent. Fr.*, VII (5), pp. 447-466.
- SCHIÖDTE, J. C. (1861-1872). De Metamorphosi Eleutheratorum. Forste Bind, Pars II, pp. 70-74, Tab. VIII, Fig. 1-18 (1864); Pars VI, pp. 176-177; 203-207, Tab. VIII, Fig. 1-13 (1872).
- THOMSON, C. G. (1857). Skandinaviens Coleoptera Synoptiskt bearbetade, Lund.
- WICKHAM, H. F. (1895). The Coleoptera of Canada. VIII. The Haliplidæ and Dytiscidæ of Canada. *Canadian Ent.*, XXVII, pp. 69-70.

EXPLANATION OF ABBREVIATIONS USED.

a. Muscle of maxilla.	<i>mc.</i> Middle coxa.
ac. Antecoxal piece.	<i>mp.</i> Maxillary palpi.
c. Coxa.	<i>ms.</i> Mesosternum.
ca. Cardo.	<i>mt.</i> Metasternum.
e Eye.	<i>pc.</i> Posterior coxa.
cm. Epimeron	<i>pg.</i> Palpiger.

cp. Episternum.

pl. Palpifer.

g. Galea.

ps. Prosternum.

gu. Gula.

sg. Subgalea.

lc. Lacinia.

sm. Submentum.

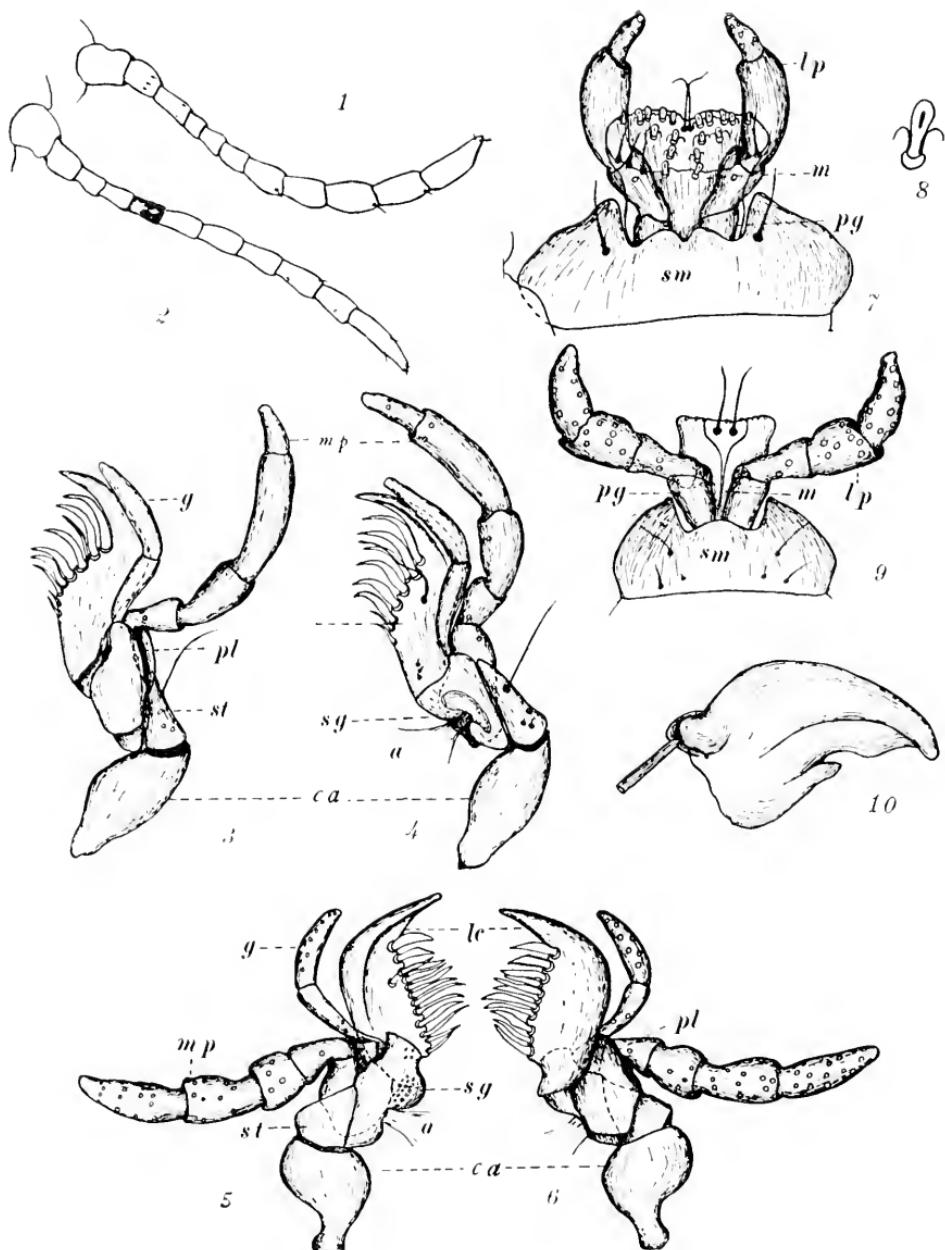
lp. Labial palpi.

st. Stipes.

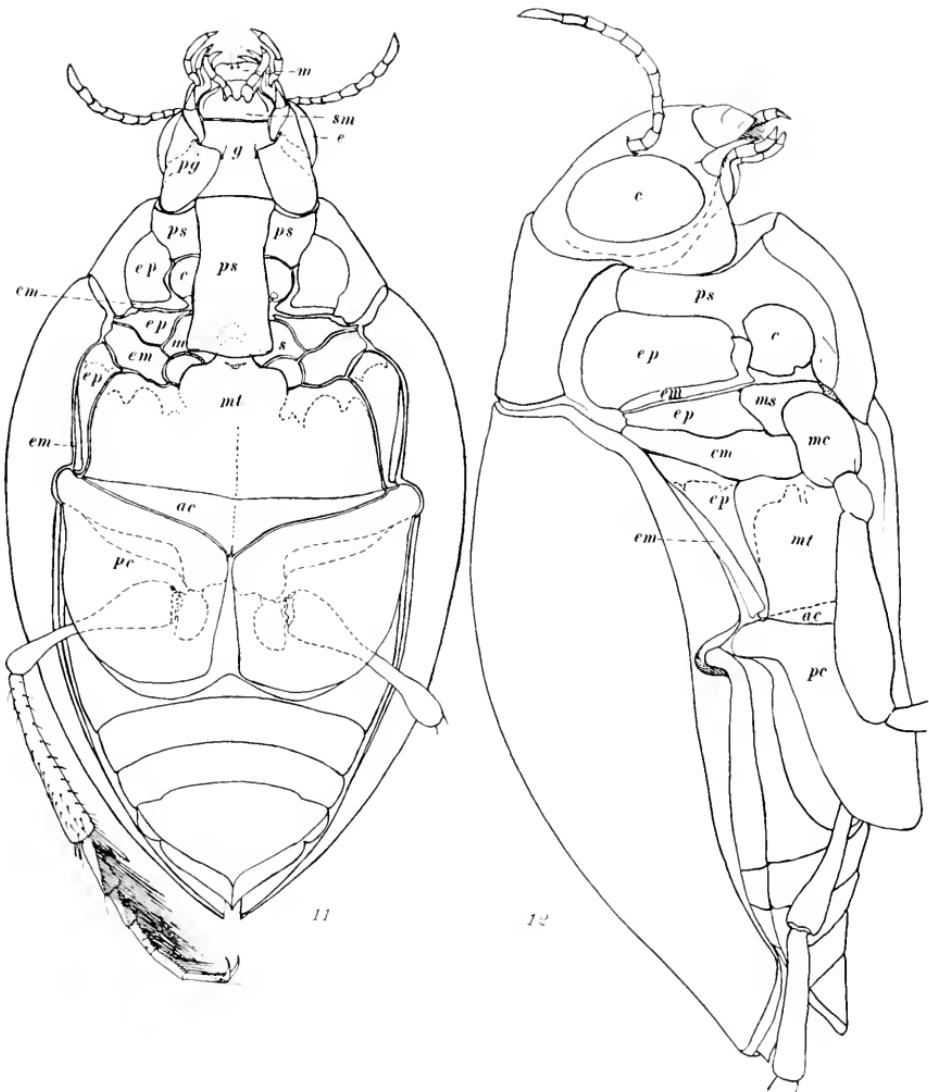
m. Mentum.

EXPLANATION OF PLATES X-XIV.

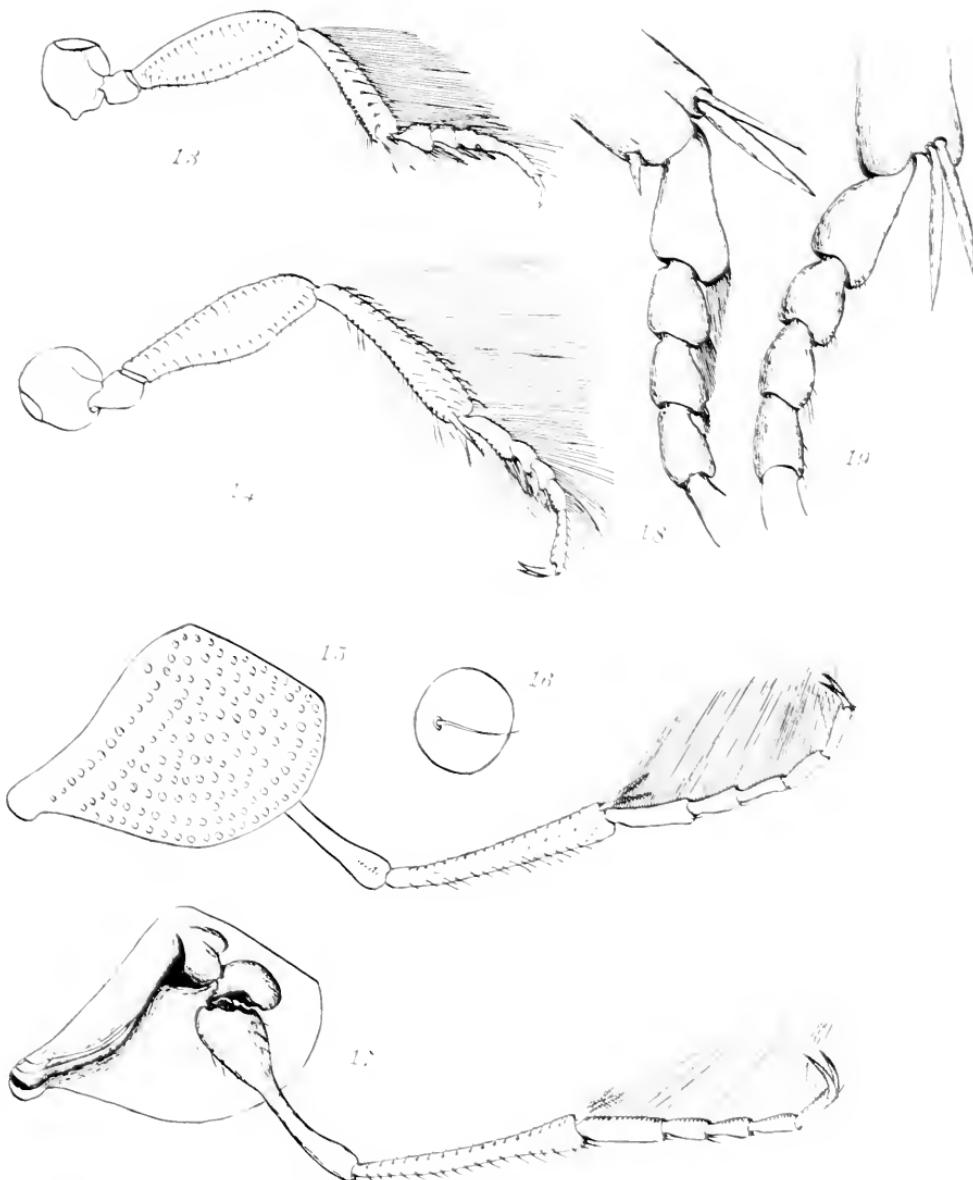
- FIG. 1. Antenna of *H. triopsis* Say.
 FIG. 2. Antenna of *P. edentulus* Lec.
 FIG. 3. Dorsal view of maxilla of *H. triopsis* Say.
 FIG. 4. Ventral view of maxilla of *H. triopsis* Say.
 FIG. 5. Ventral view of maxilla of *P. edentulus* Lec.
 FIG. 6. Dorsal view of maxilla of *P. edentulus* Lec.
 FIG. 7. Labium of *H. triopsis* Say.
 FIG. 8. Sense seta from labium of *H. triopsis* Say.
 FIG. 9. Labium of *P. edentulus* Lec.
 FIG. 10. Mandible of *H. triopsis* Say.
 FIG. 11. Ventral view of *H. triopsis* Say.
 FIG. 12. Lateral view of *H. triopsis* Say.
 FIG. 13. Anterior leg of *H. triopsis* Say.
 FIG. 14. Middle leg of *H. triopsis* Say.
 FIG. 15. Hind leg of *H. triopsis* Say.
 FIG. 16. A setiferous pit from posterior coxa of *H. triopsis* Say.
 FIG. 17. Hind leg (dorsal view) of *H. triopsis* Say.
 FIG. 18. Anterior leg (tarsi) of male of *H. triopsis* Say.
 FIG. 19. Anterior leg (tarsi) of female of *H. triopsis* Say.
 FIG. 20. Left mandible of larva of *P. edentulus* Lec.
 FIG. 21. Right mandible of larva of *P. edentulus* Lec.
 FIG. 22. Mandible of larva of *H. ruficollis* DeG.
 FIG. 23. Labium and maxillæ of larva of *P. edentulus* Lec.
 FIG. 24. Anterior leg of larva of *H. ruficollis* DeG.
 FIG. 25. Anterior leg of larva of *P. edentulus* Lec.
 FIG. 26. Antenna of larva of *P. edentulus* Lec.
 FIG. 27. Hind leg of larva of *P. edentulus* Lec.
 FIG. 28. Dorsal spine of larva of *P. muticus* Lec.
 FIG. 29. Dorsal spine of *P. edentulus* Lec.
 FIG. 30. Portion of a dorsal spine of larva of *P. edentulus* showing the trachea and its tracheoles.
 FIG. 31. Termination of a trachea in three tracheoles in the terminal joint of a larval spine.
 FIG. 32. Eggs of *H. ruficollis* DeG. in the stems of *Nitella*.
 FIG. 33. Eggs of *P. edentulus* and *P. muticus* on *Chara*.
 FIG. 34. Larvæ of *P. edentulus* and *P. muticus* feeding on filamentous algae.



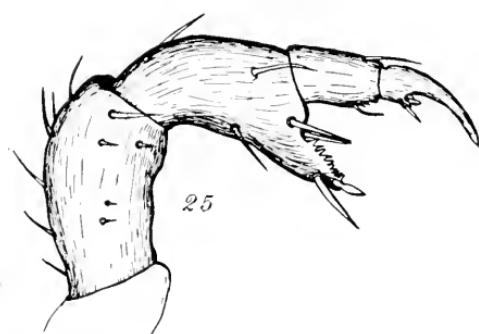
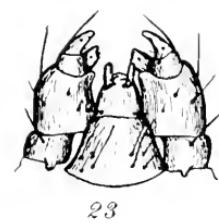
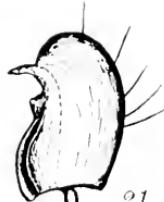
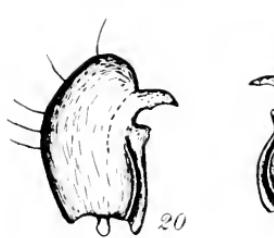
Haliplidæ.



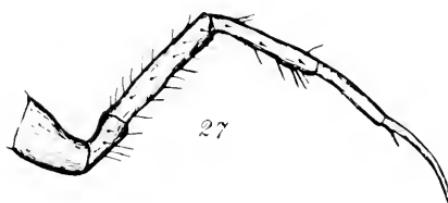
Haliphidae.



Haliplidae.



26

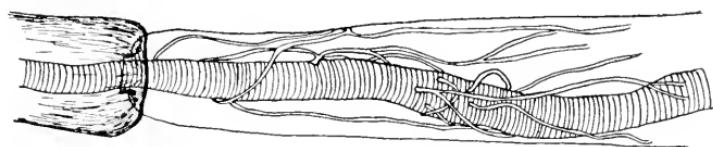


27

28



29

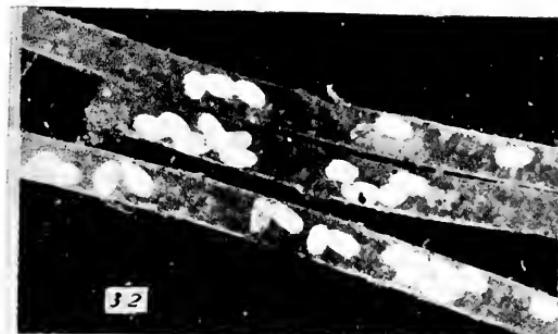


30

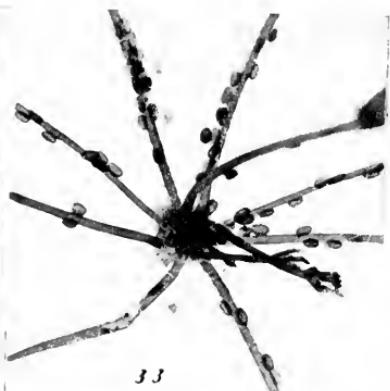


31

Haliplidæ.



32



33



34



35



36



37



38

Haliplidæ.



B. hornii.



H. mimeticus.



H. deceptor.



H. connexus.



H. fasciatus.



H. cibrarius.



H. nitens.



H. punctatus.



H. triopsis.



H. borealis.



H. lewisi.



H. longulus.



H. ruficollis.



P. callosus.



P. simplex.



P. edentulus.



P. muticus.



P. pedunculatus.



P. duodecimpunctatus.



P. litoralis.



P. floridensis.

Haliplidæ.

- FIG. 35. Mature larva of *P. edentulus* Lec.
 FIG. 36. Mature larva of *H. ruficollis* DeG.
 FIG. 37. Larva of *P. muticus* Lec. in its pupal chamber.
 FIG. 38. Pupa of *P. muticus* Lec.

PLATE XV.

Elytra of the various species of *Haliphus*, *Peltodytes* and *Brychius*.

MISCELLANEOUS NOTES.

Larva of Brachys in Oak Leaf.—In November, 1911, Mr. Wm. T. Davis and I found, near Lakeland, Fla., several Buprestid larvae concealed between the upper and lower surfaces of old partly dried oak leaves, apparently mining the leaves. Our attention was attracted by a swishing noise coming from leaves beaten into the umbrella, which, on holding a leaf to the light, was found to be caused by the larva moving its head rapidly from side to side, and thus rubbing against the inner surface of the cell in which it was concealed. Later more were detected on the trees by the noise they made, but they were not numerous, nor was it easy to ascertain the particular leaf from which the noise came. The oak was identified by Mr. Davis at the Turkey Oak (*Quercus catesbeii*); the beetles emerged in May, 1912, from leaves brought home to Staten Island, and prove to be *Brachys ovata*.—CHAS. W. LENG.

Male of Heliocheilus lupatus.—*Heliothis lupatus* Grot. was founded on a ♀ only; the characteristics of the genus *Heliocheilus* are well defined only in the male. Hampson in the Catalogue of the Lepidoptera Phalaenæ places *lupatus* in *Heliocheilus* (treated as a sub-genus) with only the female before him. There is a ♂ in the American Museum of Natural History from Tryon, N. C., showing the characters of *Heliocheilus* very well, but somewhat less developed than in *H. paradoxus*. The foveæ on the forewing are present but largely (probably when fresh, fully) scaled. The modification of the costa is similar.

The fore tibiae in this series are unsatisfactory for determination of genera, and I doubt if *Heliocheilus* can be held distinct from the tropical *Raghuva* and several other genera may be best united with *Heliothis* (*Chloridca*).

In the material before me *H. armiger* has three or four graded outer spines and one inner, tibia almost as long as first joint of tarsus, and long claw two fifths as long. *H. dipsacea* is more generalized, with longer tibia, shorter long claw and five outer spines in all. *H. ononis* has two series of spines, varying toward the lower forms.

Heliocheilus has become more specialized; in *H. paradoxus* the fore tibia is decidedly shorter than the first joint of the tarsus, flattened, with much larger terminal claws and only one spine high up in the tuft of scales. *H. lupatus* is quite similar. *Chloridca* as typified by *virescens* is quite like *H. dipsacea*.

Heliocheilus may stand then as rather unsatisfactory genus, defined by the lack of spinules on the fore tibiae, and sexual modification (usually or always?) associated with sound-production in the male.—WM. T. M. FORBES.

Baiting for Beetles at Eagle Rock.—About the 1st of May, 1909, while collecting butterflies and beetles at Gt. Notch, N. J., I came across a half pint cream bottle that had been discarded by some picnickers the previous summer and which was literally filled to the brim with beetles of several species but mostly *Geotrupes splendidus*, *Necrophorus tomentosus* and *marginatus* and some smaller species. I emptied the contents of the bottle carefully on paper and examined the insects, but they were so old and brittle and packed so closely that it was impossible to get a single specimen fit to pin. I did not then have a specimen of *Geotrupes splendidus* in my collection, so decided to bury a number of bottles somewhere in the Orange Mts. the following September and try to secure a good series. Saturday, September 3, I went to Eagle Rock and buried a dozen bottles a little back from the road among the bushes and all within a half mile of the Rock.

The bottles were buried so the opening would be level with the ground and most of them had about a quarter of an inch of condensed milk in the bottom; some had first a layer of earth and then the condensed milk and three or four contained a little of the sugaring mixture that I had often used for sugaring at night for moths, consisting of beer, molasses, and sugar and a little asafœdita, to give it a strong odor.

The bottles were in the ground a full week and then I journeyed to Eagle Rock anxious to see if my experiment had proved a success. The first bottle examined contained several *Geotrupes* and a number of common *Carabidæ* and I was much pleased and knew at once that my hopes would be more than realized. Every bottle examined contained from one to six or eight *Geotrupes* in addition to a number of other species. One contained a mouse in an advanced stage of decomposition and in that bottle I obtained a number of *Necrophorus tomentosus*. After examining the contents of each bottle carefully it was rebaited and left to be looked at the following week.

In all I made three trips to gather the specimens, viz. September 10 and 17 and October 8, and as I had then collected as many of the *Geotrupes splendidus* as I could handle, in addition to numerous other specimens, did not care to continue the experiment further. In all several hundred beetles were taken, of which the following species were the most interesting to me: *Geotrupes splendidus*, of which I took in all 80 specimens, *Geotrupes egerici*, *Myas coracinus*, and *Cymindis cribricollis*.

The bottles containing the condensed milk proved to be the most attractive and contained the greatest number of beetles, most of which were dead when examined but in good condition. In the bottles with earth in the bottom the *Geotrupes* had buried themselves in the dirt and were alive when taken and the bottles containing the syrup had only a comparatively few insects in them.

In baiting for beetles near Washington, D. C., I have always found the sugaring material by far the best bait and have abandoned the use of condensed milk entirely.—ERNEST SHOEMAKER.

BOOK NOTICE.

Genera Insectorum, diriges par P. WYTSMAN, 103me Fasicule. Lepidoptera, Heterocera, Family Geometridæ, by LOUIS P. PROUT. 1910.

It is always a pleasure to see a needed piece of work well done, and probably there is nothing more desirable at present than a revision of the world's genera of Geometridæ, and certainly it could not have been better executed than by Mr. Louis B. Prout in *Genera Insectorum*.

To date but two of the contemplated six parts of the work have appeared. In the first part, in an introduction, the history of the family is reviewed, beginning with the tenth edition of Linnaeus's "Systema Naturæ." This is followed by a discussion of the general characters of the family, the early stages, and the subdivision of the family.

Three main groups are recognized which are represented by six subfamilies, four contained in group *A*, and one each in the other two groups, *B* and *C*. Group *A* contains the subfamilies Brephinæ, Oenochrominæ, Hemitheinæ (= Geometridæ), and Acidalinae (= Sterrhinæ)¹; group *B* consists of the Larentiinæ (= Hydriomeninæ together with Dyspteridinæ); and group *C* of the Geometrinæ (= Ennominæ).

Besides the introduction, the first part of the work contains the revision of the Brephinæ. The author recognizes in this subfamily two genera and seven species; *Brephos* typified by *B. notha* of Hübner has two sections, the second of which contains our North American species, *infans* and *fletcheri*, *Melanis* Boisd. and *californicus* Boisd., the specific identification of which has not yet been positively established, are mentioned in a note. *Leucobrephos* contains only two species of which one, *bryphoides*, occurs in America. This part of the work is illustrated by one plate showing structural characters of the family, and a moth of each genus and section of the Brephinæ.

The second part of the work (104me fascicule) deals with the Oenochrominæ, which is admitted to be a fusion of a number of small groups generally accepted as representing the more ancestral forms of the Geometridæ. The subfamily is divided into three tribes. Oenochromicæ, the first and largest of the tribes, contains 96 genera and over 400 species, about 35 of these latter being new. The tribe is world-wide in its distribution but is predominantly Australian, is but weakly represented in the palearctic fauna, and contains but one nearctic species, *Alsophila pomctaria*. Ametridicæ and Hedylicæ are relatively small tribes with a neotropical distribution, consisting of 9 genera and 46 species almost evenly divided between them. The former contains the only other two Oenochromids which occur in our fauna, *Armetris* (*Mecoceras*) *nitocris* and *Almodes terraria*, both

¹ *Synomila*, *Paota* and *Hæmatopis* are included in this subfamily.

essentially Central American species but which invade our southern borders.

Geometridists generally can feel grateful to Mr. Prout for the excellent and very thorough piece of work he is doing. One of the greatest handicaps to Lepidopterists is the fact that in many families genera have not been considered with reference to those of the world, but rather new genera after new genera have been erected when only those of a relatively small region was known to the describer. With the literature scattered this method of working could scarcely be avoided, unless, indeed, a student absolutely refused to diagnose any species whose structure placed it quite outside the pale of any genus known from his particular region—even though that region embraced the while of one faunal realm, in which case he would be tolerably secure. But with Mr. Prout's work completed (and we trust that the other parts will follow in rapid succession) there will be little excuse for duplicating genera in the Geometridæ. Of course, we may not always agree with him as to what constitutes generic or subgeneric characters but this is a minor consideration and in no way detracts from the excellence of the work or lessens its usefulness.—JOHN A. GROSSBECK.

PROCEEDINGS OF THE NEW YORK ENTOMOLOGICAL SOCIETY.¹

MEETING OF MARCH 7, 1911.

A regular meeting of the New York Entomological Society was held in the American Museum of Natural History, March 7, 1911, at 8.15 P. M., with the president, Mr. Leng, in the chair and fifteen members present.

In the absence of Mr. Dickerson, Mr. Engelhardt acted as secretary pro tem.

The arrangement for a joint field meeting with the Brooklyn Entomological Society over Decoration Day at Yapank, L. I., was referred to Mr. Engelhardt.

Mr. Olsen's resignation as a member of the field committee was accepted and Mr. Sleight appointed in his place.

¹ Owing to unavoidable circumstances, the publication of the Society's minutes has been greatly delayed in the past. Such material as is in the hands of the Publication Committee is presented herewith at the request of the Society.

Mr. Comstock spoke on Lycenidae and based his remarks upon material collected by Mr. Hallinan in the Panama Canal Zone, which region he pointed out as a natural dividing line for many South American species. A beautiful series of specimens particularly rich in Theclas was shown. Mr. Hallinan obtained 51 of the 121 species recorded from the Panama Canal region. In flight Mr. Hallinan mentioned that some of the large iridescent Theclas resemble *Morphos*; others persistently frequent the tops of tall thorn trees where their capture requires much patience and considerable forbearance. Thus of *polybe* and *regalis* after a week's trial in the tops only four specimens were secured.

Mr. Shoemaker told of his collecting experience at Washington, D. C., where he spent two weeks last year during June accompanied by Mr. Davis. He obtained about 3,000 specimens of Coleoptera and Lepidoptera, many of which were new to his collection. Most of the collecting was done on the slopes of the Potomac, both on the Maryland and Virginia sides. Part of his catch including the following species was shown: *Panagaeus fasciatus* Say, *Platynus eaudatus* Lec., *Callida viridipennis* Say, *Odontonyx trivittis* Germ., *Sandalus petrophypa* Knoch, *Chalcolepidius viridipilis* Say, *Trichius delta* Forst., *Calligrapha amelia* Knab, *Bellamira scalaris* Say, *Cacoplia pullata* Hald., *Statira croceicollis* Makl., *Nemognatha cribalaria* Lec., *Cirrhophanus triangulifer* Grt., *Mamestra marinitincta* Harvey, *Plagiomimicus pityochromus* Grt., *Acontia aprica* How. A large number of Carabidae, Scarabaeidae, etc., were captured in bait bottles, of which seventy were planted and regularly inspected. Excepting condensed milk, which proved not very productive, only a mixture of molasses such as collectors of Lepidoptera generally apply to trees was used as bait.

Mr. Davis showed a number of photographs of the Potomac River region near Washington and also many species of insects of various orders, among them the large bot fly *Cuterebra horripilum* Clarke, the rare dragonfly *Neurocordulia obsoleta* Say, and the little cricket *Myrmecophila fergandi*, which latter species, he thought, ought to be found in New Jersey if looked for in its habitat—ants' nests. Attention was called to the average larger size in a series of *Carabus limbatus* Say from Washington as compared with a series of the same species from the mountains of southern Georgia. As an instance of the predicament a collector is apt to find himself in, Mr. Davis cited his experience in the capture of a beetle *Calligrapha amelia* Knab. The beetle was observed in a difficult position for capture among the twigs of a bush of nimbark, its food plant. But what rendered proceedings still more difficult was the discovery of a copper head coiled below. Mr. Davis had the satisfaction of exhibiting both beetle and snake.

Mr. Pollard spoke on the occurrence of *Chlorippe celtis* at Washington, where at times the butterfly is exceedingly abundant.

Mr. Davis exhibited twenty-four species of insects that he had found attending the glands on the upper side of the leaves of *Populus grandidentata* and called attention to two of them, a bee of the family Halictidae and a

Crabro wasp which he had observed flying from leaf to leaf and visiting many different glands. It was pointed out that the insects were probably not guided by color in this instance as they would have been in visiting flowers.

Mr. Schaeffer showed a pair of Scarabæid beetles, *Friihstorferia sexmaculata*, from Tonkin China, calling attention to the peculiarly elongated mandibles of the male.

MEETING OF APRIL 4, 1911.

A regular meeting of the New York Entomological Society was held in American Museum of Natural History, Tuesday, April 4, at 8.15 P. M., with President Leng in the chair and eleven members present.

The minutes of the previous meeting were read and approved.

Mr. Grossbeck, chairman of field committee, reported that the next field meeting would be at Roselle Park, April 16.

Under scientific discussion Mr. Barber spoke concerning some Hemiptera including seven new species taken mostly at Lakehurst, N. J.

Mr. Dow, who had recently gone to Jamaica with Mr. Grossbeck, discussed the occurrence of *Papilio homerus* in that island.

Mr. Grossbeck reported briefly on the trip. He had found good collecting at Kingston, where he spent a few days, but otherwise the collecting was not considered good. Poor results were obtained from beating and only three places were found for water collecting. Many specimens of insects were noted in some cases but only a few species.

Mr. Davis exhibited a specimen of *Libellula incesta* Hag. taken at Lake Hopatcong in 1908, with the hind wings shorter by 5 mm. than the fore-wings, and a specimen of *Deilephila lineata* Fab. in which the wings were of normal breadth but unusually short.

MEETING OF APRIL 18, 1911.

Held at the American Museum of Natural History at 8.15 P. M., with President Charles W. Leng in the chair and sixteen members in attendance.

In the absence of the regular secretary, Mr. Barber was appointed to act as secretary pro tem.

The librarian, Mr. Schaeffer, reported the receipt of publications recently received as follows:

Bulletino della Soc. Entomol. Italiana, XLI, Nos. 1-4.

Boletin do Mus. Goeldi, VI.

Wiener Entomol. Zeit., XXX, Nos. 1, 2, 3.

Georgia State Board of Entomology, Circular No. 10 and Bulletins Nos. 33, 34.

Deutsche Entomol. National Bibliothek, II, Nos. 3, 4, 5, 6.

Verhandlungen d. K. K. zool. bot. Gesellschaft in Wien, LX, Nos. 9, 10.

Coleopterorum Catalogus, Pt. 28.

Mr. Grossbeck, of the Field Committee, reported a successful outing at Roselle Park, N. J., on April 16, at which five members were present. The next outing to be at Jamesburg, N. J., on April 30.

Mr. Osburn, of the Photograph Committee, exhibited an engraved photograph of Prof. John B. Smith presented by Mr. Davis, and one of Mr. Hallinan. Also two views taken in the Panama Canal strip by the latter.

Mr. Engelhardt mentioned the proposed Decoration Day outing at Yaphauk, L. I., from May 27-30. Miss Weeks had promised to accommodate those who attended.

The curator reported on the progress of the work with the local collection. He suggested that the Seifert collection of Lepidoptera should officially be presented to the Museum.

Upon motion of Mr. Angell the secretary was instructed to inform the Museum of the donation of this collection by the N. Y. Entomological Society.

Mr. Leng spoke on *Brachyacantha* and exhibited his collection. He described particularly the distribution and the sexual characters. He referred to the work of Verhoeff on the genitalia, showing in a drawing, in which the parts were extruded, the paramera, penis and siphon described by that author. He said that his paper on the genus was nearly ready to print and would include drawings of all of the species but two thus far described from any part of the world.

Mr. Engelhardt spoke of his collecting experiences on Long Island, illustrating his remarks with a number of insects, principally Coleoptera and Lepidoptera. He pointed out that while much collecting had been done in the western part of Long Island, especially in the vicinity of Brooklyn, the central and eastern parts had been much neglected. That in view of the topography and varied vegetation many interesting records may be expected from the last named regions. Of special interest among the insects shown were: *Dytiscus harrisii*, *Cyllene crinicornis*, both from Forest Park, Brooklyn, the former a northern beetle, the latter a southern or western species, and its occurrence on Long Island probably accidental. *Albuna pyramidalis* from Bay Shore, the first record from Long Island, is essentially a mountain species, though widely distributed throughout the United States. Its food is as yet unknown. *Sesia sigmoidea* from Woodhaven and Amaganset. A number of specimens were bred from the stalks of low willows growing near the sea shore, but none were found in the roots as reported by Mr. Joutel, who first discovered the food plant.

Mr. Wintersteiner exhibited the few species of *Berosus* found in the vicinity of New York City. He spoke of the characters and distribution of these species.

Mr. Davis and Mr. Barber spoke concerning their recent collecting experience in Cape May, N. J., mentioning some of the interesting species collected. Mr. Davis mentioned the number of specimens of the poisonous spider, *Lathrodetes*, observed or captured under logs and read an article concerning this species in the October number of *Everybody's Magazine*. They took 58 species of Hemiptera mostly under boards.

Mr. Pollard remarked that the seventeen year cicada had made its appearance in the pupal stage on Staten Island as he had noticed them in Clove Valley.

MEETING OF MAY 2, 1911.

Held at the American Museum of Natural History at 8.15 P. M., President C. W. Leng in the chair with twenty-one members and two visitors present.

In the absence of the regular secretary, Mr. Barber was appointed to act as secretary pro tem.

The minutes of the preceding meeting were read and approved.

Mr. Osburn, of the Photograph Committee, exhibited photographs of Henry G. Hubbard and Mr. Otto Seifert.

The curator, Dr. Lutz, reported on the progress of the work with the local collection.

Mr. Grosbeck, of the Field Committee, reported that six members enjoyed a profitable trip to Jamesburg, N. J., on April 30. The excursion to Ramsey, N. J., was to be postponed from May 14 to May 21.

Mr. Sleight exhibited three views of field meetings presented by Dr. Lutz.

Mr. Southwick reported that the collection of Dr. Zabriskie was ready for the inspection of any of the members who cared to see it, but its final disposal was uncertain. It was desirable however to keep the collection intact.

Mr. G. W. J. Angell moved that a committee be appointed to examine the collection and report upon the desirability of securing it to form a part of the local collection.

Dr. Southwick and Dr. Lutz were appointed by the president as the committee.

Dr. Raymond C. Osburn spoke on "Digestion in Insects," illustrating his remarks by numerous lantern slides. After showing a chart explaining the various steps in nutrition Dr. Osburn exhibited illustrations and remarked concerning the various kinds of digestive tracts in insects, and compared the processes of digestion with those in man.

Dr. Lutz's paper on "Geology and Insects" was accompanied by a number of interesting slides showing the geological changes which have taken place in the conformation of New Jersey and spoke concerning the effect of these changes on the dispersal of insect life. Considerable discussion followed concerning the dispersal of southern insects along the coast, in which the ocean currents were an important factor according to Professor Smith.

Mr. Shoemaker exhibited some moths from East New York, which were presented to the local collection.

MEETING OF MAY 16, 1911.

A regular meeting of the New York Entomological Society was held May 16 at 8.15 P. M. in the American Museum of Natural History, with President Leng in the chair and twenty-six members present.

Minutes of the previous meeting were read and approved. The curator reported progress in the identifying and cataloging of the local collection. The librarian reported the receipt of the following publications:

Canadian Entomologist, Vol. XLIII, No. 5.

Deutsche Entomologische Nat. Bibliothek, Vol. 2, No. 9.

Entomologische Blätter, Vol. VII, No. 4.

Coleopterorum Catalogus, parts 29-30-31.

Deutsche Entomologische Zeitschrift, 1911, No. 2.

Bull. No. 235 N. J. Agr. Exp. Station.

Index and title page to Vol. 1, Science Bulletin Museum Brooklyn Institute.

Mr. Grossbeck, chairman of the outing committee, proposed a field trip to Ramsey, N. J., on May 21, and May 27-31 inclusive to Yaphauk, L. I. Mr. Engelhardt stated that recent forest fires in the vicinity of Yaphauk might interfere somewhat with collecting in that vicinity.

Under miscellaneous business Mr. Barber read letters from Dr. Crampton, head of the department of invertebrate zoology in the Museum, and Dr. Henry F. Osborn concerning the disposition of the Seifert collection. They expressed their gratification over the active work the society was doing in building up a local collection and stated that in view of the fact that the collection in question consisted largely of local material they authorized that it be retained under the supervision of the society with the other local material.

Mr. Dow, on behalf of the Brooklyn Society, extended an invitation to the members to attend the June meeting of that society which would be of a social character.

Moved by Mr. Barber and carried that as customary the June meetings be omitted.

Dr. Southwick invited the members to accompany the Torrey Botanical Club on a collecting trip to Springdale, L. I., the following Saturday.

Under scientific discussion Mr. Davis exhibited specimens of *Anosia plexippus* taken April 25 at Lakehurst and Jamesburg and May 17 at Staten Island; he also showed 26 species of Hemiptera found by himself, Mr. Shoemaker and Mr. Engelhardt on May 14, in the washup on Rockaway Beach. Among those exhibited were *Stethaulax marmoratus* Say, *Æbalus pugnax* Fab., *Hymenarcys nervosa* Say, *Perillus circumcinctus* Stal, *Perillus exaptus* Say, *Mencicles insertus* Say, *Elasmucha lateralis* Say, *Leptoglossus corculus* Say, *Largus succinctus* Linn., *Lygaeus bicerucis* Say, *Echtrichodia cruciata* Say and *Pygolampis*.

Mr. John Angell exhibited two boxes of Lucanidæ, of the group Odontolabini and the other of Lamprinæ.

Mr. Sleight exhibited a large series of specimens of *Lina scripta* and *Lina lapponica* showing much variation in color, which he has collected.

Mr. Barber exhibited a specimen of *Cicada septendecim*, which had emerged in a greenhouse at Roselle Park, N. J., on May 13. He also showed 6 newly described species of Hemiptera.

Mr. Schaeffer commented on several interesting insects which he exhibited, including two species of Neuroptera, *Mantoida maja*, the Mexican Pierid, *Eucheira socialis*, the larvae of which make a tough nest and feed at

night, a green form of *Cicindela ranquebarica* collected at Wyandanch, L. I., *Anisodactylus lodingi* Sch., a new species from Alabama and interesting in that the head of the male is small, while that of the female is large; *Merope tuber*, a scorpion fly from Black Mts., N. C.; and a series of the N. American species of *Carabus* including *Carabus cancellatus* from Wisconsin.

Mr. Shoemaker showed specimens of *Sphaeridium scaraboides* and *bipustulatum* collected at East New York early in May.

Dr. Lutz exhibited larvæ and adults of *Anthrenus fasciatus*, which had been found feeding on hair in an upholstery establishment in Georgia. The species is European, being found in Spain, Algeria, Russia and elsewhere and this is believed to be the first record of its occurrence in America.

A box of European Coccinellidæ was shown by Mr. Leng.

Mr. Englehardt brought up the subject of hibernation of insects which provoked some discussion among the members.

MEETING OF OCTOBER 3, 1911.

The regular meeting of the New York Entomological Society was held in the American Museum of Natural History, Tuesday Evening, October 3, 1911, at 8.15 P. M., with President Leng in the chair and twenty members present.

Mr. Davis, the treasurer, reported:

Balance in Society account	\$1,210.20
Balance in Journal account	39.00
Total.....	\$1,249.20

The curator, Dr. Lutz, commented on the change in the society's meeting place from that in the balcony to the present one in the room formerly occupied by him. This change was necessary, owing to the fact that the former location would have to be used as an entrance to the new wing of the building when it was completed. Dr. Lutz also reported for the committee appointed to look after the Zabriskie collection, and stated that the committee had consulted with Dr. Zabriskie's heirs and they had requested that the society dispose of the collection as Dr. Zabriskie would have desired.

Moved by Mr. G. W. J. Angell and carried that the society present the collection to the Museum.

Suggested by Dr. Lutz that the local material in the collection be placed in the society's local collection.

As the relatives of Dr. Zabriskie had desired to know the size of the collection the secretary was directed to send them the number of specimens represented when ascertained.

Mr. Geo. J. Keller, of Newark, was proposed for membership by Mr. Grossbeck. Moved by Dr. Lutz that the by laws be suspended and on motion the secretary cast the vote of the society for Mr. Keller.

Mr. Davis stated that he had received a letter from Mr. Wm. Schaus requesting three back numbers of the Journal. Moved and carried that the desired copies be presented to Mr. Schaus.

Mr. Leng stated that the work on the Elateridæ in the local collection would be taken up the following Saturday.

Under scientific discussion Mr. Grossbeck spoke on the abundance in this locality the past September of the migratory moth, *Aletia argillacea* Hbn. This discussion was participated in by several members, all reporting the insect very abundant and records were obtained as far distant as Providence, R. I., and Buffalo, N. Y.

Dr. Lutz spoke of some examples of mimicry which he had observed in a recent trip to South America. While in British Guiana, S. A., he saw what he supposed to be brown ants running upon some leaves. Upon capturing the insects, however, and examining them he found that they were a species of Diptera. No ants were found in the immediate vicinity but some were obtained in the forest under the leaves, while the flies had been captured on leaves in an open area. He questioned very much whether this could be considered a case of mimicry. On another occasion he observed on the leaves of an acacia what appeared to be a number of Membracids or Aphids each attended by an ant. On capturing some and examining them more closely he discovered that they were a species of Membracidae with the branching appendages of the pronotum so developed as to closely resemble an ant. So close was the resemblance that when the insects were being mounted the one mounting them attempted to separate the ants from the insects.

Dr. Lutz read from a paper by Professor Poulton, in which he discussed the large number of forms of Membracidae with the thoracic appendages developed in a similar manner.

Dr. Crampton made some interesting remark upon the recent South American trip. They had gone down through the West Indies and stopped at several points, including Martinique and St. Lucia, making intensive studies and obtaining a conception of the obvious insect and invertebrate fauna. From thence he went into British Guiana. For the first 180 miles the country with its forests was found to be very flat. Then hills arose to a plateau of 1,300–1,400 ft. altitude. Up the rivers and through the forests very striking examples of Cryptical coloration in Orthoptera, Hymenoptera and a few Lepidoptera were noted. The country rose gradually to an altitude of 1,600 ft. near the borders of Brazil, where the cliffs rose 5,000–6,000 ft. Much material had been collected to be worked over. From the conditions observed the following general facts were noted in a given habitat: (1) In forests of the same type on different slopes certain organisms of the same type occurred; (2) In any particular forest some forms characteristic of and peculiar to that altitude occurred; (3) Irrespective of altitude in a given river system certain characteristic types occurred.

Mr. Leng asked concerning the distribution of any tiger beetles noted. Dr. Crampton said that a species had been observed on the coast that had not been found on the Amazon side of the mountains.

Mr. Leng stated that a similar condition might be inferred from the distribution of *Cyphrus violaceus* in Georgia. This species was described by

Leconte from the Nakutshi Valley, which is traversed by the Tallulah River. Diligent search in the neighborhood of Clayton, Ga., carried on for two seasons by four collectors failed to disclose its presence there. The locality searched is about twenty miles from the original locality, but on Stekoaa Creek instead of Tallulah River. The only specimen obtained during the two years was taken by a friend at Burton, Ga., which is again on the Tallulah River. While the evidence is negative and incomplete, it surely points to the distribution of the species being locally confined to the valley of the Tallulah.

Mr. Wm. T. Davis showed specimens of the grasshopper *Dendrotettix quercus* Riley, and stated that the insect had defoliated many oak trees in the vicinity of Ridgway, N. J., in 1910 and 1911. Specimens had also been collected near Lakewood and Lakehurst, N. J., but in less numbers. Photographs of large white oaks entirely stripped of their leaves were shown and it was pointed out that if the next few years are favorable to the species, this grasshopper introduced from the southwest may become a serious pest in New Jersey.

Mr. Shoemaker stated that he had been collecting in the vicinity of Washington late in June and early July and again in September. He had obtained some 2,500 beetles on the first trip and 450 the last time. Several interesting forms were taken and some of these exhibited.

Mr. Sleight reported the capture of *Calosoma sycophana* at Ramsey, N. J.

Mr. Pollard reported *Catocala herodias* Strek., at Lakehurst on July 4.

The latter species has also been taken by Mr. Bucholz and Mr. Davis and it was noted that when found at sugar it did not fly off in an excited manner as the other species, but rested low on the trunk and moved off with a slow flight through the low shrubbery. This habit he thought might account for its apparent rarity. He also reported the capture of a variety of *Limenitis astyanax* at Pine Island, N. Y., in June when collecting there in company with Mr. Angell.

Mr. John Angell said that at Pine Island in an area covered with water he had collected a number of specimens of *Carabus limbatus* from stumps and noted that they were more reddish in color and coarser in punctuation than those usually found.

Mr. Barber had collected during August at Herndon, Va., near Washington, D. C. His material was not yet arranged for exhibition.

Mr. Engelhardt stated that he had collected several times during the season at Yaphank, L. I., and has made some interesting captures including *Cychrus elevatus*. He had taken as many as sixteen of these in ten minutes while looking at base of ash trees for *Xyloryctes satyrus* Fabr. In digging in the borings of the latter he had found two *Cychrus* in one tree and three in another. He considered these captures interesting in view of the fact that the locality was not one which would be considered a *Cychrus* country. He also reported *Carabus sylvosus* from the same locality at sugar.

Dr. Southwick reported on the progress of the botanical collection of food plants of insects and said he had added many additional notes.

Mr. Schaeffer exhibited a specimen of *Leptura abdominalis* taken at Lakehurst by Mr. Schott. He also stated that two species of walking sticks occurred in this locality and had been noted in material from Long Island and from Essex Falls, N. J., *Diapheromera veliei* Walsh and *Diapheromera femorata* Say. All the material from the above localities consisted of females.

Mr. Wm. T. Davis stated that *Diapheromera veliei* Walsh had been found on Staten Island and at Paterson, N. J. *Diapheromera femorata* Say, had been collected by him at Tuckerton, Manasquan, Jamesburg and Ramapo, N. J. The species are most easily told apart by the genitalia, as pointed out by Mr. Andrew N. Caudell in the Proceedings of the U. S. Nat. Museum.

Mr. Davis also exhibited a copy of the recent publication "A Guide to the Insects of Connecticut, Ereplexoptera and Orthoptera of Connecticut," by H. Walden.

Mr. Schaeffer showed a copy of the publication "A Preliminary Catalogue of the Described Species of Fulgoridae of America North of Mexico," published some time ago by the Ohio Department of Agriculture.

Mr. Sherman stated that he had made a trip to the Lake Superior region. He had found collecting very unfavorable except along the beach. He had had twenty-one good days collecting at the latter point and took some 400 species and between 8,000 and 10,000 specimens. He spent one week at St. Paul and three weeks at Rochester in Minnesota and had visited Professor Washburn at the Experiment Station. He also had one very good day collecting at Edge Brook, near Chicago, in company with Professor Shelford.

Mr. Leng exhibited a few beetles received from Rev. T. P. Thorman, collected at Tahl Tau Mission House, Telegraph Creek, in the Cassiar District of British Columbia, about 58° N. latitude. The Cicindelidae were represented by two specimens of *C. longilabris* without white markings and greenish metallic beneath, approaching the variety *vestalia*, establishing a far northern range for the species. Among the Carabidae were several specimens of *Calosoma tepidum* with very roughly granulated surface, approaching a species described from Fort Vancouver under the name *anescens*. The locality is a little further inland than Glenora, visited by Professor Wickham some years ago, and further collections by Mr. Thorman will be interesting.

Mr. Franck reported that *Pamphila ethlius* had been found feeding on the canna in some numbers near Maspeth, L. I., last season. Mr. Englehardt had noted the species in a flower garden in Prospect Park, Brooklyn. The occurrence in numbers was interesting, owing to the fact that the species is southern in its distribution.

MEETING OF DECEMBER 19, 1911.

A regular meeting of the New York Entomological Society was held at the American Museum of Natural History, President C. W. Leng in the chair with seventeen members present, and as visitors J. Chester Bradley and Mortimer Leonard, of Cornell University.

Upon motion Mr. Barber was appointed to act as secretary pro tem. in the absence of the regular secretary.

Mr. Henry Bird under title of "Rye's Newest Moth" related his experience of finding the larvae of what he took to be *Apemea nictitans* boring in the stems of a peculiar giant grass growing in the tidal marshes near Rye. Upon rearing the larvae however he was surprised to find that he had probably secured a new species of the genus. It appears to be close to *Apemea erepta* Grote, collected in Kansas by Professor Snow, the type of which is in the British Museum. Specimens of the moth have been sent to Mr. Hampson to compare with the type before a definite conclusion can be reached. Specimens were exhibited.

Mr. John Sherman exhibited a collection of beetles taken along the southern shore of Lake Superior in June of this year and stated that the Coleoptera were almost identical with those found about 3,700 feet up, on Mt. Washington, below the tree line. He referred to the previous results of other collectors in this region, notably LeConte, Schwartz, Hubbard, Wickham and the expedition of the U. of Michigan. As a result of these various efforts about 1,500 species of beetles had been listed from the region of Lake Superior. Hubbard states that the fauna of this lake is richer in number of species of Coleoptera than the lower lakes. Mr. Sherman read an extract from the writings of Mr. Schwartz, 1877, in which he discusses the occurrence of insects along the beach.

Most of Mr. Sherman's collecting experience was limited to two weeks in June in the vicinity of the Huron Mt. Club to the west of Marquette and later near the latter place. He described the character of the country and the condition of the collecting about these two places. But as collecting was disappointing in the smaller surrounding lakes and country, he stuck mostly to the beach collecting, in which he had two or three days of good collecting, with the lake winds favorable, in each of the localities visited. Few insects were noticed on the beach besides beetles—and of these the most common families were Elateridae, Cerambycidae and Buprestidae. Altogether he took 8,000 specimens, adding about 25 species to the list of the beetles of this region. He was disappointed, however, in his search for water beetles. He mentioned particularly the rarer species taken.

Mr. Leng suggested that the non-occurrence of certain forms was due to the fact that the species found on the beach were determined by the season.

Dr. J. Chester Bradley, of Cornell University, was called upon by the President for some remarks. He responded by giving his experience in accidentally finding a number of the rare and peculiar Hemipteron *Henicocephalus culicis* Uhl. at Clayton, Georgia. As these remarks are to be published in the "Short Notes" of the Journal it is not necessary to duplicate them here.

Mr. Bradley also spoke concerning the equipment and work of the Cornell Entomological Department.

Mr. Leonard and Mr. Plunkett, students at Cornell, spoke briefly in response to the request of the President.

Mr. Leng exhibited the four species of *Plusiotis* which occur in the

United States: *lecontei*, *gloriosa*, *woodi* and *beyeri*. The latter was from Arizona and *woodi* added by Mr. Wenzel from northern Texas.

Mr. Leng also exhibited *Erochomus scapularis* Gorh. from the Huachuca Mts., Ariz. He spoke of the distribution of Coccinellidae brought from Jamaica by Mr. Grossbeck, among which were:

Brachyacantha bistrispustulata from Brownsville, Tex., through Central America to Brazil.

Cyclonedda sanguinea var. *immaculata*, including slight variations from the United States, including California, throughout Central America, West Indies and South America to Brazil.

Psylllobora nana, from Cuba and Jamaica. Closely allied species occur throughout United States, Central America, South America to Brazil and West Indies.

Psylllobora nigro-vittata, described from Jamaica.

Hyperaspis connectens from West Indies and Mexico.

Procula douei, described from Jamaica.

Scymnus, several small species not named.

Of the six species, two are, so far as known, peculiar to Jamaica, the remainder are found also in tropical America, i. e., Brownsville, Texas, Mexico, Central America, Venezuela, Colombia and Brazil. Two extend into temperate United States, but in modified form.

MEETING OF JANUARY 16, 1912.

A regular meeting of the New York Entomological Society was held January 16, 1912, at 8.15 P. M. in the American Museum of Natural History, President Dr. Raymond C. Osburn in the chair and sixteen members present.

The resignation of Mr. A. C. Weeks as a member of the Society was read and, on motion of Mr. Angell, was accepted with regret.

Mr. Leng spoke of the *Cicindelidae* of the West Indies and exhibited the specimens in the collection of the American Museum and those in the collection of Mr. Harris, loaned for the purpose. He stated that three species of the genus *Tetracha* were known to occur in the West Indies and nine species of the genus *Cicindela* and that of the twelve species six were confined to the West Indies. Of the remaining six, five occur also in South America, one occurs also in the United States. Of the five which occur in South America, two are widely distributed and reach Central America and the United States as well as the West Indies. The strong relation with South America and the considerable number of species peculiar to the West Indies are apparently remarkable features of the tiger beetle fauna, but further data are required to make this certain.

Mr. Schaeffer spoke of the longicorn beetle *Crioprosopus magnificus*, and exhibited specimens of it and allied species. He stated that this species could not be referred to *Crioprosopus* with complete propriety, nor to any other established genus. The limitations of genera throughout the family Cerambycidae are such as to require the erection of new genera often for a single

or a few species, and this insect is an example of the conditions that necessitate so large a number of genera. The number of antennal joints is twelve in this species, eleven in other species of the genus. It also differs from the other species in the form of its thorax. In some respects it is nearer to the genus *Purpuricenus* but differs again in the form of the mesosternum and has been transferred to the genus *Crioprosopus* on that account.

Mr. Schaeffer referred to the suggestion of Bates that a division of the genus be based on the punctuation of the thorax, and to the uncertainty of divisions based on the visible margin of the elytra and stated finally that the species could not properly be included in any known genus.

Mr. Schaeffer also spoke of *Tenochila virescens* and allied form, stating that on looking up the description of the synonyms he found that it would be justifiable to restore some of the older names. It is difficult to say which form is the true *virescens* of Fabricius, but assuming that the type was received through Drury to have come from our Southern States, as is most probable, the name *virescens* would apply to our eastern form in which the punctuation of the abdomen does not differ materially in the sexes—*chlorodia* Mann. is a Pacific form which should rank as a variety, *acrea* Lee. is probably a dark form of *virescens*, *acuta* Lee. is, however, a valid species and as pointed out by Sharp differs by having the punctuation of the abdomen entirely different in the sexes, ♀ sparsely, ♂ closely punctate and is moreover a larger insect, with more parallel form and with the sensitive spaces of the ninth and tenth antennal joints much larger. As a variety of *acuta* the form from Arizona called *nycta* by Mr. Dow at a recent meeting may be placed, characterized by the anterior groove of the head being obsolete. Mr. Schaeffer said that specimens from Texas approached this form very closely, though a close study of long series might support its claim.

Dr. Lutz, under the title "West Indian Triplets" described the journey made by Professor Crampton, Mr. Miner and himself to the West Indian Islands last summer, illustrating his remarks with lantern slides and radiopticon views. He first, using the map and relief topograph as illustrations, briefly outlined the geography and geology of the islands, especially emphasizing the three geologic groups into which they may be divided and the mountainous character of all of the islands visited. Then St. Thomas, St. Croix, St. Kitts, Antigua, Guadalupe, Dominica and other islands were each described in some detail, with numerous illustrations of the scenery, collecting grounds, etc. St. Thomas, long cultivated and largely deforested, did not impress him favorably as a locality of biological study, though it offered surprising opportunities for collecting caterpillars, the natives pointing out caterpillar trees, so-called from the abundance of larvæ. St. Croix in place of barren hillsides presented well-watered valleys to the view with streams and fertile banks. Night sweeping here yielded good results, but the shores though apparently well fitted to sustain tiger beetles were disappointing. Antigua's shores were inhabited by two species of *Cicindela*, and *Tetracha* was there found under stones. Rain interfered very seriously with collecting, but good results were obtained in sweeping along the margin of

the woods. Guadeloupe, larger than the islands previously mentioned, but only half as large as Rhode Island, was next visited but without striking success, and greater effort was expended in Dominica where the party remained three weeks, during which time Dr. Lutz was able to collect for several days each at Roseau, at sea level and at Laudat, at an elevation of about 1,800 feet.

Sweeping proved remunerative along the margins of mountain streams, one night's sweeping yielding 700 specimens. Beating was not successful. Sifting, usually poor on account of the thin covering of leaves on the forest floor, was occasionally very good where a suitable pocket could be found. Sugaring and collecting at light were not usually successful and Coleoptera were decidedly in the minority, Diptera and Hemiptera being more abundant. Almost incessant rain was a continual handicap and mossy and tree-fern covered mountains did not abound in desirable insects. Digging into old logs, cutting down forest trees to reach the insects concealed in the growth of epiphytes, and other strenuous methods were used to accumulate the great mass of specimens Dr. Lutz, in spite of all difficulties, was able to show.

After some collecting in the Botanic Gardens and at Long Ditton, where a curious orthopterous insect, locally called "ting ting" and making a noise like sleigh bells, was found by hunting in hollow trees, Dominica was left for a visit to Martinique, St. Lucia and Barbadoes. On account of the lateness of the hours these islands were passed quickly and finally Trinidad, simply with the statement that as to fauna it was practically a part of the mainland of South America.

Following Dr. Lutz's remarks, the insects caught arranged according to habitat, were exhibited and several were shown upon the screen with the radiopticon. An informal discussion of the results of the trip was joined in by many members.

Mr. Davis exhibited a specimen of *Polypleurus nitidus*, caught November 19, 1911, at Newberry, Fla., killed in alcohol, kept there for several days, and still, after nearly two months, not dry, but soft and limber, so that the legs and antennæ were movable. Many other specimens of the same species, caught at the same time and treated in the same way, were dry and brittle.

Mr. Schaeffer said that such experiences were not unusual with the large *Tenebrionidae*.

MEETING OF FEBRUARY 6, 1912.

A regular meeting of the New York Entomological Society was held February 6, 1912, at 8.15 P. M., in the American Museum of Natural History, President Dr. Raymond C. Oshburn in the chair, and twenty members and two visitors present.

Mr. Barber spoke of the Hemipterous insect "*Lygaeus turcicus* Fab. and its Allies." He said that four species, *turcicus*, *kalmii*, *costalis* and *reclivatus* were so frequently confused that the records of their distribution were not entirely to be depended upon. The similarity in their color characters, by which alone they are separable, has led Uhler to regard them all as varieties

of *turcicus*; but Stål, the most careful and accurate systematist, with the material before him, regarded them as distinct species. Mr. Barber, with blackboard drawings to illustrate his remarks, gave the characters by which the species are separable and the distribution of each.

L. turcicus Fab. has the red mark on the vertex forked anteriorly, the clavus before the middle red, the membrane black with its edge and surface concolorous. It was described from New York, but is apparently rare in this vicinity. Stål had material from Illinois, Montandon from Pennsylvania, Missouri and Colorado. About Washington, D. C., Mr. Banks has taken it on *Ceanothus* (New Jersey Tea) and Mr. Engelhardt has a specimen from Long Island.

L. Kalmii Stål has the red mark on the vertex usually quadrate, the clavus black and the membrane more or less broadly banded with white and with or without a white discal spot. It varies considerably in its markings, and Stål lists var. *A*, transverse red band of pronotum entire, white discal spot of membrane distinct. Var. *B*, transverse red band of pronotum divided into three spots, white discal spot of membrane distinct. Var. *C*, membrane black without discal white spot or prominent white border. Var. *melanodermus* Mont. described in 1893 from St. Louis, Mo., is more melanic than the above. The varieties *A* and *B* are western; var. *C* is common in summer on milkweed throughout the east and is often confused with the preceding.

L. reclivatus Say clavus red, behind black or marked with black, membrane narrowly bordered with white, with or without discal white spot and two small triangular white spots at base, hemelytra ornamented in the basal interior angle with a small black spot. Described from Missouri Territory, which Mr. Barber showed by map, is not synonymous with our present state of that name, and known from southwestern states and Mexico. Var. *enotus* Say lacks the discal white spot of membrane. . . .

L. costalis H. S. seems to differ mainly in the reduction of the size of the black spot on the costal part of the hemelytra. It is closely related to *reclivatus* and doubtfully recognized in specimens from Arizona by Mr. Van Duzee.

Mr. Barber exhibited specimens of the species referred to.

Mr. Comstock spoke "On some *Lycanidae* from New Mexico and Old Mexico" and said that material collected by John Woodgate at Jemez Springs, Sandoval Co., New Mexico, contained many interesting species, contrasting sharply with the fauna of Fort Wingate, where this collector was formerly located. He exhibited *Thecla itys*, *culanus* and *arota*, taken at the Jemez Springs locality. He also spoke of species taken in Central Mexico at Cuernavaca, *Everes comyntes*, *Hemiargus hanno*, to the wide range of the former and the differences between the latter and species described in the *Biologia*. Mr. Comstock also spoke of the variations in these and other species of *Lycanidae* and exhibited one of his boxes showing a series of males both upper and under side, with females also showing upper and under side arranged below. Apart from the variation series he showed homotypes, i. e.,

specimens carefully compared with the type and metatypes or specimens labeled by the author.

Mr. Comstock closed with a reference to a recent article by Dr. Barnes on *Thecla elytie*, *leda* and *ines*, protesting against the union of the three species and expressed the opinion that such union was unwarranted.

Dr. Lutz added that Cuernavaca, mentioned by Mr. Comstock was south of the City of Mexico, on the Pacific slope and in a very mountainous region. Mr. Harris spoke of the "Cicindelidae of the York Coast, Maine," describing the locality and exhibiting series of the four species found there, viz: *repanda*, *hirticollis*, *marginata* and *generosa*, with specimens of the same species from other localities to show the racial differences observed. Both *marginata* and *generosa* were found close to the surf and flying together, an unusual environment for *generosa*. Mr. Harris's paper will be printed in full in the JOURNAL.

It was discussed by Messrs. Leng, Angell and Lutz. Mr. Angell stated that he had found *generosa* at Ipswich, Mass., in a valley between sand dunes. Dr. Lutz said that he had collected crickets on the York Coast and in protected coves found southern forms, while northern forms inhabited the tops of the cliffs.

Dr. Osburn said that certain marine forms were found in sheltered coves further north than they could be found in general.

Mr. Barber presented a specimen of *Anthophilax malachiticus* taken at Fort Montgomery, N. Y., by himself a few years ago, to the local collection, also a specimen of *Toxotus vittiger*.

MEETING OF FEBRUARY 20, 1912.

Held at the American Museum of Natural History at 8.15 P. M. President Raymond C. Osburn in the chair with fifteen members and one visitor in attendance.

In the absence of the regular secretary Mr. Barber was elected secretary pro tem.

The curator, Dr. Lutz, exhibited some of the Carabidae of the local collection to show how the work was being carried on by the members interested. He stated that the collection of Neuroptera, donated by Mr. Grossbeck to the local collection was arranged and another installment of Dr. Southwick's "food plants" had been received.

Dr. Lutz, for the publication committee, asked that written suggestions be submitted to the committee in reference to the future conduct of the JOURNAL.

Mr. Davis presented the resignation of Mr. Ellison A. Smyth, of Blacksburg, Va., as an active member. On motion of Mr. Angell the resignation was accepted with regret.

Mr. Lutz by aid of the radiopticon gave an illustrated talk on "Geographic Distribution of Environment" based on Schimper's "Plant Geography upon a Physiological Basis."

Mr. Davis read a paper "Insects on a Recently Felled Pine Tree," and exhibited a box containing the results of this experience. Mr. Davis also exhibited specimens of some of the more important plants upon which they collected insects in Florida.

MEETING OF MARCH 5, 1912.

A regular meeting of the New York Entomological Society was held at the American Museum of Natural History, President Dr. Raymond C. Osburn in the chair and seventeen members present.

Mr. Mutschler gave some "Notes and Exhibition of Some Species of Cerambycidae in the Collection of the American Museum of Natural History." He referred particularly to the four described species of *Tragosoma*, all of which are treated by Hamilton as one under the name *depsarium*. He called attention to the error by which Casey's species are treated as female by Hamilton while the description expressly states the male sex; and to the differences in pilosity as well as in other characters between Casey's species and *depsarium*. He also referred to specimens of *Necydalis mellitus* taken at West Farms and to be added to the local collection, and to a Mexican specimen of *Purpuricenus* like *humeralis* in color and form. Mr. Mutschler, referring to the general collection said that it contained a total of 1,125 species, 368 North American, 757 foreign, having recently been enlarged by a gift from Mr. Leng; he called attention to some of its especially interesting features, the types of *Anthophilax hoffmani* Beut, the type of *Molorchus longicollis* from the Edwards collection and the series of Black Mountain longhorns collected by Beutenmuller, including the curious ant-like *Michtysoma heterodorum* found running on oak trees.

Mr. Mutschler's remarks were discussed by Messrs. Schaeffer and Leng on the subject of *Tragosoma*, the former pointing out the instability of the characters used to separate *harrisi*, *spiculum* and *ilosicollis* from *depsarium*, the form of the tooth at the side of the thorax, the punctuation, the pilosity and the form of the body being all equally variable; the latter maintaining that while the great similarity indicated a common origin for all the forms described, the differences were sufficient to warrant considering the names as indicative of geographical races rather than as synonyms.

Mr. Davis, speaking of his experience in collecting *Michtysoma* in the mountains of Northern Georgia, said that they were not confined to oaks. That tree being abundant in the mountains often showed *Michtysoma* running on its trunk but the same was true of other trees also. He said the insect was locally abundant on Black Rock Mountain in June but was not found in July, and was not equally distributed over the mountain, but more abundant in places on the ridges at an elevation of about 3,500 feet. Mr. Grossbeck read a paper on "The Value of Genital Armature in Systematic Work," illustrated by drawings thrown on the screen by the radiopticon. As a preliminary he stated that he had never found differences in genitalia that

were not correlated with differences in structure or maculation and that the great value of the genitalia lies in the positive confirmation they afford of specific differences less definitely indicated by other characters. Mr. Grossbeck then outlined the work that has been done on genitalia, referring to the papers of Herold, Kirby and Spence, Burmeister, de Haan, Scudder and Burgess, White, Grosse and Pierce, showing on the screen the different parts and the varying names that have been applied to them and expressing a regret that a greater uniformity in this respect does not prevail. He passed next to examples of insects superficially similar but readily differentiated by the differences in the genitalia, which in each case were shown on the screen. These included *Pero morrisonatus*, a boreal species, and *Pero marmoratus*, a species of the transition zone, which are very similar, distinguishable only with difficulty unless fresh and perfect, but entirely unlike in genitalia. *Catopyrrha coloraria*, which has been listed with three varieties, but an inspection of the genitalia shows two distinct species are concerned. *Selidosoma* sp., from San Diego, which appears to be a variable species until examination of genitalia shows that it is divisible into two sections which are then found to be also divisible by color characters; the *Glaucina-Canochatis* group of about twenty species from the desert regions of the southwest, which afford another instance of the value of genitalia in separating species; *Cicada lyricen* and *similaris*, which are practically indistinguishable from above, but different beneath and totally unlike in genitalia.

The paper was discussed by many of the members, all agreeing as to the value of the genital armature as a court of last resort. Mr. Leng called attention to the papers by Verhoeff on the genitalia of Coleoptera. Mr. Schaeffer spoke of the great value of the genitalia in *Lachnostenra*, especially the females, which are practically inseparable otherwise; which, however, as has been demonstrated, are as variable as any other structures, but not more so. Dr. Lutz referred to recent studies in *Bombus* as confirmatory of Mr. Grossbeck's statements and pointed out that an observed identity in genitalia would aid in establishing synonymy as well as observed differences would aid in establishing validity of similar species. Mr. Davis said that genitalia might be similar, but species nevertheless distinct as in certain *Cicada*. Dr. Osburn referred to the terminal abdominal appendages, homologous with claspers of other orders, in dragon flies as affording most valuable characters for classification.

Mr. Davis then exhibited the recently published volume on the "Plants of Southern New Jersey," by Witmer Stone, and called especial attention to his division of the Coastal Plain in Southern New Jersey, viz: West Jersey or Middle, Pine Barrens, Coastal Strip, Cape May and Maritime. He also referred to the entertaining historical features of the volume and read extracts from the quoted letters of Dr. Torrey, dated in 1818. Mr. Davis also exhibited Hemiptera collected by himself in Florida last November and determined by Mr. Barber. He said that many specimens were smaller than the normal size for the same species.

Mr. Dickerson exhibited and presented to the local collection specimens of *Tragidion coquus* collected in Cumberland Co., N. J., in September, on the flowers of immortelles or straw flowers, growing near a wood in which pine and deciduous trees occurred.

Dr. Osburn called attention to an article in the Ohio Naturalist in which L. B. Walton describes *Symbiotes duryi* and gives a discussion of its position and habits. The beetles were found under slightly decayed hard-wood log, which was partly covered with one of the lower forms of fungi. The author points out that *ulkei* and *minor* have been erroneously referred to *Symbiotes*, being really referable to *Rhymbus*.

Dr. Osburn also presented to the library papers on dragon flies, which were duplicated in his own library and suggested that all the members might aid the library by doing likewise.

MEETING OF MARCH 19, 1912.

A regular meeting of the New York Entomological Society was held March 19, 1912, in the American Museum of Natural History, at 8.15 P. M., President Dr. Raymond C. Osburn in the chair, with 17 members present.

The field committee reported that the three principal excursions of 1912 would be Decoration Day to Lakehurst, July 4 to Newfoundland, and Labor Day to Yaphank, and that probably additional shorter trips could be arranged on suggestion by any member having a good place in mind, and that such could be announced through the Bulletin.

Mr. Grossbeck announced the death on March 12 of Prof. John B. Smith, and offered the following preamble and resolution, which on motion of Mr. Angell was unanimously adopted:

WHEREAS the New York Entomological Society has learned with deep sorrow of the death of Professor John B. Smith, Sc.D., state entomologist of New Jersey, professor of entomology in Rutgers College, and corresponding member of the Society, Therefore be it

Resolved that the regret of the members of the Society for the great loss sustained by them and the science of entomology, in the untimely death of a friend and fellow worker, be expressed in this form and entered on the minutes of its meetings and that a copy of this resolution be sent to his family.

Mr. Engelhardt under the title "Notes on Lepidoptera collected in Florida in November" described his four weeks journey in Florida last November, during which he visited Jacksonville, St. Augustine, Anastasia Island, Daytona, Palm Beach, Miami, Knights Key, Key West, Tampa, Ocala, Leesburg, Sanford, Enterprise, Palatka, returning to Jacksonville by the St. Johns River, spending about two days in each place and five in Miami, where he was able to spend some time on Biscayne Bay, and to ascend the Miami River to the edge of the Everglades. Mr. Engelhardt spoke of the long leaf pine, cypress, Spanish moss and palmetto becoming conspicuous features as soon as the Savannah River was reached on the way south, and of the live

oaks which replace in part the deciduous oaks of the north. For each of the places visited he mentioned the features affecting the insect life, the dense growth of live oak and bayberry on Anastasia Island, and the wash-up on its beach, the sand dunes, moist meadows and wild flowers back of the beach; the great arc lights at Daytona making good evening collecting there as well as the varied swamps and pine woods back of the town; the great plenty of insect life among the varied subtropical vegetation at Palm Beach and Miami, especially upon the blossoms of the pawpaw in the subtropical swamps across the Miami River; the excellent collecting to be found in the suburbs of Key West and Tampa, quickly reached by trolley, and in the cypress swamp near Ocala easily penetrated by reason of an old railroad track. Mr. Engelhardt exhibited a selection of the Lepidoptera caught during his journey divided to show the differences between the northern half of the state where forests of long leaf, yellow and scrub pine are found, and where northern trees like sweetgum, sourgum and tulip still occur, the region subject to killing frost as far as oranges are concerned; and the southern half of the state including only species which were not found in the northern half, this southern half being characterized by the absence of Spanish moss and the presence of introduced subtropical plants and broader leaved epiphytes. He called attention to the effect produced in some species by a continuous food supply, a continuous development apparently resulting therefrom. For instance the larva of *Artace punctistriga* was found on live oak trunk and developed into imago within five days, and in the case of *Liminetis* larvæ the hibernaculum usual in the north was absent. In other cases, however, while no true hibernating stage can be alleged, there is a quiescent or resting season. Thus a chrysalis of *Papilio cresphontes* is still unhatched and larvæ of *Limacodidae* are still unchanged. There may be a connection between the differences observed in the behavior of these insects and the abundance of certain butterflies compared with the seasonal absence of others. The influence of climate and continuous food supply needs further study to elucidate the problems suggested. Mr. Engelhardt spoke also of the effect of cooler mornings in making the insect take refuge among the leaves of trees and bushes by which the beating and sweeping became more productive at such seasons. Owing to the lateness of hour he did not comment on the individual species captured, of which a list will be published later.

Mr. Grossbeck showed the Lepidoptera collected in Florida during the same month by Dr. Lutz and Mr. Leng. He pointed out as specially interesting the Geometer *Glena texanaria* taken by Dr. Lutz and speaking of the Geometers taken by Mr. Engelhardt said that *Stenotrachelys approximaria*, *Synelys timandrata* and *S. subquadrata* were especially rare, each being previously known by one or two specimens outside the type.

Mr. Davis exhibited thirty-eight species of Florida butterflies which he obtained during the same month of November at Jacksonville, Lakeland and Punta Gorda. Twenty-three of them belonged to species more or less common in the vicinity of New York or in New Jersey, while fifteen species were

more southern. Among those of chief interest were *Pamphila arpa*, *Pamphila striga* and *Pamphila florida*. Also a *Papilio asterias* taken at Lakeland, Fla., that was flying about with but three wings, the lower left hand wing being undeveloped and represented by a pad of 6 mm. in length.

Mr. Davis also exhibited specimens of three species of the Hemipterous genus *Pselliopus*, including the recently described species *barberi*. On Long Island, Staten Island and in New Jersey *P. cinctus* only has been collected, while in Maryland and Virginia *P. cinctus* and *P. barberi* occur together.

Mr. Wintersteiner gave a "Note on *Hydrophilus*" illustrated by specimens of the species and drawings of the abdomen and tarsal joints. He pointed out the character by which the genera recognized by European authors are separated and those by which the species *insularis*, *triangularis*, *ater* and its variety *intermedius* are to be known, by which it appears that *ater* occurs in Florida, Antilles and Central America.

Mr. Wintersteiner's paper will be published in full in the JOURNAL.

Mr. Schaeffer exhibited two specimens of *Coccinella undecimpunctata*, part of a number taken at Wollaston, Mass., by Mr. Johnson, September 5, 1911. This is a European species which appears in the last Henshaw supplement to the Check List, but is not mentioned by Colonel Casey, and is treated in Mr. Leng's paper as unknown in America except doubtfully by its variety *menetriesi*.

MEETING OF APRIL 2, 1912.

A regular meeting of the New York Entomological Society was held April 2, 1912, in the American Museum of Natural History, at 8.15 P. M., President Dr. Raymond C. Osburn in the chair, with sixteen members present.

The curator reported continued work by Mr. Mutschler on the local collection and exhibited a part of the collection of spiders in vials, which in addition to the authentic name showed also the synonyms. He called attention to the value of this collection, in which are incorporated the collections of Pike and of Petrunkevitch and the identifications of Emerton.

Mr. Hall exhibited a number of specimens and spoke on "Collecting Butterflies in the White Mountains"; he illustrated on the blackboard the relation of the localities visited and spoke particularly of the following species: *Œneis (Chianobas) semidea* and *Brenthis montinus*, both rather common on Mt. Washington, in Tuckerman's Ravine and on the side of Mt. Pleasant, *montinus* occurring as low as the tree line and *semidea* even lower down, the best season for these butterflies being the first week of August. *Eugonia (Grapta) J-album*, *Polygonia (Grapta) faunus*, *P. progne* were abundant at Crawford House and at Jefferson Highlands about August 15, but of *P. gracilis* only one specimen was taken. These species appear to be somewhat local in their distribution, for at Sugar Hill one year there were no *J-album* or *progne*, though plenty at Profile House only three miles away. *Euryimus (Colias) pilodice* was represented by a variety approaching *anthyale*, smaller than the typical form and flying at the end of July. *Cercyonis*

(*Satyrus*) *alope* was abundant at Sugar Hill in the form *nephela* only. *Argynnis atlantis* was very common. *A. aphrodite*, represented by a small dark form was also common at Sugar Hill. *A. cybele* was however rare. *Pontia (Pieris) napi* form *oleracea* was also abundant.

Mr. Hall's remarks were discussed by Messrs. Comstock, Forbes, Engelhardt, Sherman and Dr. Osburn. Mr. Comstock said that *Eugonia J-album* feeds on white birch (*Betula populifolia*) and quoted also Mr. Watson's records at Sloatsburg, N. Y., June 7 and at Alpine, N. J., June 10, where the larvae were abundant, almost every tree having a colony. Mr. Engelhardt mentioned apple as another food plant and suggested that it might be a general feeder. Mr. Comstock thought there might be some error, as in his experience it was confined to white birch. It was also said that *P. faunus* feeds on willow, and *P. progne* on currant. The small dark forms of *Argynnis* mentioned by Mr. Hall were stated to be repeated on the coast of Maine and to be probably a result of cold and moisture.

Mr. Leng read a paper on "Coleoptera collected in Iceland by L. P. Gratacap," in which the island was described and the relation of its insects to those of other northern regions discussed. The beetles collected by Mr. Gratacap, comprising nearly all the ground beetles known to occur in Iceland, were exhibited.

Mr. G. W. J. Angell exhibited specimens of *Carabus chamissonis* from Alaska, the type locality, and from the White Mountains, Labrador and Greenland, the last having received the varietal name *groenlandicus*, and remarked that this variety was smaller and more oval than the others, and that it was omitted in the list of Greenland species prepared by J. C. Nielsen for part 2 of the insects of the Denmark Expedition.

Dr. Lutz exhibited a specimen of the geometer *Brephos infans* caught at Ramsey, N. J., on March 31, and remarked that it should be included in the New Jersey list.

A discussion of the distribution and habits of this insect was held by Messrs. Comstock, Forbes, Bischoff, Hall, Sleight, Engelhardt and Pollard and it appeared that it occurred at Worcester, Mass., Hemlock Falls, N. J., Jamesburg, N. J., Wayandanch, L. I., on Staten Island and at Sloatsburg, N. Y., always in places where its food plant, white birch, was abundant and very early in the season; the dates being from March 29 to April 30. Often it flies high among the tree tops, but at times close to the ground according to weather conditions. Subsequently Mr. Comstock supplied exact records as follows:

Brephos infans, Hemlock Falls, N. J., April 6, 1902, saw several and caught one flying high (Watson and Comstock); Hemlock Falls, N. J., April 20, 1902, saw four (Watson and Comstock); Hemlock Falls, N. J., March 29, 1903, saw one (Comstock); Jamesburg, N. J., April 23, 1905, caught one (Watson); Sloatsburg, N. Y., April 23, 1905, caught one (J. H. Cook); Sloatsburg, N. Y., April 30, 1905, saw two (C. H. Sunderland).

Psychomorpha epimenis, Sloatsburg, N. Y., April 30, 1905, common (C. H. Sunderland).

Feralia jocosa, Ramapo, N. J., May 15, 1904, caught one (Watson).

Mr. Pollard mentioned the similarity in the flight of *Brephos infans* and *Psychomorpha epimenis*, which latter species Mr. Comstock said was common at Sloatsburg.

Mr. Engelhardt mentioned *Feralia jocosa* as another species of early appearance, abundant among the hemlocks between Scarsdale and White Plains, and remarked that this species hatched about the end of March regardless of the weather. Mr. Dickerson remarked that the controlling factor might be the accumulated heat units. Mr. Bischoff said that this species occurred also at Hemlock Falls, and Mr. Comstock added Ramapo, May 15, from the records of Mr. C. H. Sunderland.

Dr. Forbes mentioned *Apocheima rachelæ*, described from the Canadian Rockies, but common in New England, as another species that flew only in April snow storms.

MEETING OF APRIL 16, 1912.

A regular meeting of the New York Entomological Society was held April 16, 1912, in The American Museum of Natural History, at 8.15 P. M., President Dr. Raymond C. Osburn in the chair and twelve members present.

The curator reported on his recent work on local Mallophaga, stating that he had secured a permit to shoot birds so as to secure specimens in that parasitic order, and that an arrangement had been effected with Mr. Beebe at the Zoological Garden to secure specimens from the birds that died there.

Mr. Pollard stated that his assistant, Mr. Howard H. Cleaves, had obtained the exclusive privilege of collecting birds killed by flying against the new light house near Richmond, Staten Island, and that he would gladly turn over the Mallophaga to the local collection, as the Staten Island Association of Arts and Sciences had no collection in that order.

A letter from F. H. Wolley Dod, of Alberta, expressive of his regret upon learning of the death of Prof. John B. Smith was read.

Mr. Schaeffer nominated Dr. C. H. Tyler Townsend as an active member of the Society. On motion of Mr. Angell the by-laws were suspended and Dr. Townsend was immediately elected.

Mr. Schaeffer distributed copies of "Memoirs of The Coleoptera III," sent to him by the author, Colonel Thos. L. Casey, for the purpose.

Mr. Schaeffer offered some "Remarks on the Leconte Collection" which he recently examined in part and expressed his admiration for the reverent care with which Mr. Henshaw has preserved the specimens in their original boxes, just as they were left by Dr. Leconte. On account of this collection being the oldest and well preserved collection of North American beetles, the number of specimens it contains that have been compared with the types of foreign authors, like Mannerheim, Chaudoir and Motschulsky, as well as the very large number of types resulting from Dr. Leconte's pioneer work in Coleoptera, it is of extraordinary interest to workers in that order. Its value is greatly increased in this respect by the manner in which it has been

handled, two of the original boxes being now placed in glass-covered drawers, with Dr. Leconte's catalogue, containing his key to the colored disks largely used to designate localities. It is regrettable that it was not the custom to designate type specimens in Dr. Leconte's time. Mr. Schaeffer said there was little difficulty for an experienced Coleopterist to recognize the types, though often more than one species as now recognized, will be found under the label.

To a large extent the Leconte collection is duplicated in the Horn collection, but in many cases reference to the Leconte types is absolutely necessary to determine closely allied species. Mr. Schaeffer mentioned particularly the species of *Helephorus* which he compared for Mr. Wintersteiner and *Collops* for his own work and stated also that one of the results of his visit must be the removal of *Platynus sinuatus* from our local lists, all of Dr. Leconte's specimens being from far northern localities and not at all like our local insects.

Mr. Schaeffer's remarks were discussed by Mr. Angell and Dr. Forbes, the latter stating that the field numbers used by Dr. Harris in conjunction with his note books gave the most precise data in regard to his specimens.

Dr. William T. M. Forbes spoke on "Some Structural Characters in Noctuid Moths," illustrating his remarks by drawings thrown on the screen by the radiopticon, by boxes of specimens and by microscopic slides. The parts of the head, palpi, antennæ, the venation of the wings, the hairs of the eyes, the pupal characteristics and other characters were dealt with in an exhaustive manner, not with a view of constructing a dichotomous key, but rather to bring out the true relationship as evidenced by the aggregate of all the characters involved. Dr. Osburn at the close of Dr. Forbes' remarks expressed the gratification of the Society in listening to so able and interesting a treatment of a difficult subject.

Dr. Forbes's remarks were discussed by Messrs. Schaeffer, Comstock and Dr. Osburn and various additional points respecting the taxonomic value of the lashed eyes, the genitalia, the sculpture of the eggs, the antennal joints were brought out.

Dr. Raymond C. Osburn spoke of "Our Knowledge of the Larval Stages of Syrphidae," reviewing the published data and illustrating his remarks with the radiopticon. He exhibited specimens of *Microdon tristis* and its pupal case, *Eristalis tenax* and pupa, *Xanthogramma emarginata*, egg and female that laid it, collected by Mr. Davis, and a vial containing larva of *Microdon tristis* taken by Mr. Davis at Newfoundland, N. J., in ant's nests, commenting upon the similarity to a molluse which has in fact led to *Microdon* larvae being described as such. Dr. Osburn's paper will later be published in full.

Discussion by Messrs. Angell, Engelhardt, Pollard and Schaeffer followed; the difficulty of breeding bark species and the work of Burke being alluded to and explained by Dr. Osburn.

MEETING OF MAY 7, 1912.

A regular meeting of the New York Entomological Society was held May 7, 1912, in the American Museum of Natural History, at 8:15 P. M., President Dr. Raymond C. Osburn in the chair and 15 members present.

Mr. Pollard announced that a memorial meeting in honor of the late Prof. John B. Smith would be held on May 28, under the auspices of the Staten Island Association of Arts and Sciences, at which the members of the Society were invited to be present.

Mr. Engelhardt spoke of "Early Spring Collecting" illustrating his remarks by specimens collected at Central Park, Long Island, this spring. He said in part:

The Long Island prairie or so-called Hempstead plains finds its eastern limit at Central Park, L. I., from there on continuing east begin the typical pine barrens. The prairie is the region visited by Wm. T. Davis during the fall of 1911, when he secured the unusual record of *Tetracha virginica*. This region can be reached within one hour from either Brooklyn or New York and combining as it does prairie and pine barren, it ought to receive special attention from collectors during the present season, for the original prairie is fast yielding to cultivation. The following condensed enumeration represents part of the captures made during April, 1912:

Some of the Coleoptera collected on dead pines were: *Borus unicolor*, under bark, April 7, still hibernating and in clusters of five or six; *Coxelus guttulatus*, three specimens; *Rhizophagus cylindricus*, two specimens; *Hister parallelus*, *Platysoma lecontei*, *Plegaderus transversus*, these three Histers, especially the last named, exceedingly numerous; *Dicerca obscura*, var. *jurida*, *Alius myops*, *Corymbites cylindriformis*, *Callidium anennatum*, *Hypophilus parallelus*, common; *Batriscodes globosus*, *Tyrus humeralis*, etc., etc. The following were swarming about a pine cut during the winter or late fall, *Hylobius pales*, *Pissodes strobi*, *Dendroctonus terebrans*, *Hyliurgops glabratus*, *Phlaosimus dentatus*, *Tomicus calligraphus*, *Rhagium lineatum*, *Dinoderus cibratus*, etc. Under bark of young oaks injured by wood fires, *Lamophilus biguttatus*, *L. adustus*, *L. convexulus*, *Litargus sexpunctatus*, *Sacium lunatum*, etc. Other miscellaneous beetles *Ditoma pinicola*, *Clerus quadriguttatus*, *Eureka erichsoni*, *Serica tricolor*, *Valgus squamiger*, *Bruchus nigrinus*, *Notoxus monodon*, *Melanophthalma fumila*, *Tomarus pulchellus*, *Orsodachna atra*, var. *tittata*, common on pussy willows, *Dorytomus brevicollis* on catkins of poplar, *Xanthonia decemnotata*, *Crepidodera rufipes* beaten from Pine, *Rhino-macer pilosus*, etc.

Diptera and Hymenoptera: Large numbers collected on pussy willows. Among Diptera the Syrphidae and Tachinidae were especially well represented. Among Hymenoptera especially bees of various families. Four specimens of the large syrphid *Criorhina verbosa* were secured. *Zelima nigra*, another Syrphid, was obtained ex pupa. The larvae live under bark of decaying pine trees. They were very numerous; the first adult emerged April 20. Mr.

Engelhardt exhibited the larvæ and the pupa and stated that the pupal stage lasted about two weeks.

Hemiptera: Of especial interest was the large number of the Aradid, *Neuroctenus simplex*, found under oak bark in burned over district. They were in clusters of twenty to thirty in such situations and eggs, nymphs and adults were included. The examination of three trees disclosed at least five hundred specimens. *Fitchia nigrovitta*, considered uncommon in the winged form, *Miliyas cinctus*, *Reduvius pallescens*, etc., were actively flying about on sunny days.

Lepidoptera: Beating the branches of oaks with dry leaves still attached furnished some interesting records of Noctuidæ this spring and surprising is the number of specimens secured by this method of species usually considered rare. For example, *Copipanoles cubilis*, reckoned a northern species and recorded from Massachusetts and the mountains of Pennsylvania has to my knowledge been taken but once on Long Island, namely at Lake Ronkonkoma, by Mr. Shoemaker. Large series from Central Park are now in the hands of several collectors. The species shows great variation. Mr. Kaiser, of the Brooklyn Society, has secured eggs and the young larvæ are now feeding on oak. *Jodia rufago*, also heretofore considered rare has been taken in still larger numbers by the method of beating branches with dry leaves. Other captures include *Actinotia ramosula*, *Taniacampa subterminata*, *Scopelosoma moffatiana*, *Psaphidia resumens*, *Phoberia atomaris*, while fairly common, is difficult to capture on account of its swift flight and habitat among scrub oaks.

Butterflies on account of the prolonged cold and wet season were uncommon during April. *Thecla angustus* and *Thecla niphon* were taken on pussy willow April 17. *Thecla irus* on April 27. On that date *Lycæna pseudar-giolus*, represented by the three spring varieties was fairly common; *violacea* predominates in the pine barrens, while those taken in the deciduous forests are largely representative of the varieties *marginata* and *lucia*.

In conclusion Mr. Engelhardt again urged the members to visit this Long Island prairie near Central Park Station early in June, when the sweeping would be at its best and he predicted that many surprising records would result.

Mr. Engelhardt's remarks were discussed by Dr. Forbes, Dr. Osburn and Mr. Schaeffer. Dr. Forbes mentioned interesting forms of *Lycæna pseudar-giolus*. Mr. Schaeffer referred to a number of remarkable Long Island records of insects captured and urged that collectors should spend more time there.

Mr. Shoemaker read a paper entitled "Notes on Baiting for Beetles at Eagle Rock" which will be printed in full in the JOURNAL. This paper was discussed by Mr. Schaeffer, Dr. Osburn and Mr. Leng.

Dr. Forbes stated that the genus *Heliochilus* would have to be added to our local list. It has heretofore been known from the Southern States and the tropics. It belongs to a group which includes the cotton worm, distinguished by the depression of the front wing, which have by some been thought to be capable of producing sound.

Mr. Schaeffer said that *Carabus baccivorus* according to Roeschke is a pure synonym of *C. tædatus*, while *agassisi*, *oregonensis* and *gladiator*, the latter being new to our check list, are valid varieties of *tædatus*. The type form is confined to Alaska, *gladiator* occurs in Washington State, is narrower and has the thorax narrow to the base; *agassisi* occurs in Colorado, Utah and Arizona and has a shorter thorax; *oregonensis* is a northern form occurring in the higher mountains of the West and has a longer thorax. Neither of the last two have the ovate elytra with deep pits, which occur in *tædatus* and *gladiator*. The form called *canadensis* is simply a little smoother than *agassisi*.

Mr. Angell in discussing Mr. Schaeffer's remarks said that Dr. Van Dyke had discovered still another form in the high Sierras of California.

Dr. Lutz called attention to a volume constituting part of a series of volumes dealing with the vegetation of the earth, entitled "Phytogeographic Survey of North America" by Harschberger and stated that as the distribution of insects was intimately connected with that of the plants, such a volume would be of special interest to the members of the Society, increased by the fact that much space was allotted to the pine barrens of New Jersey.

Mr. Shoemaker stated that he had collected *Onthophagus nuchicornis* and *Sphaeridium bipustulatum* in some numbers in the swamps near East New York.

Dr. Forbes invited the members to visit during the summer at the Camp at Mount Tobey near Sunderland, Mass., where the southern limit of the Canadian zone and the northern limit of the Carolinian approach each other within 15 miles, and where trolley communication made collecting in both zones feasible.

Mr. Leng presented a proposed programme for the meetings of next fall and winter, looking to a combined effort by the members to elucidate the environment under which local insects are found.

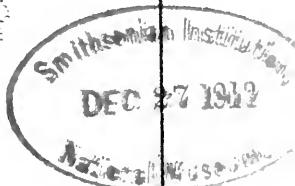
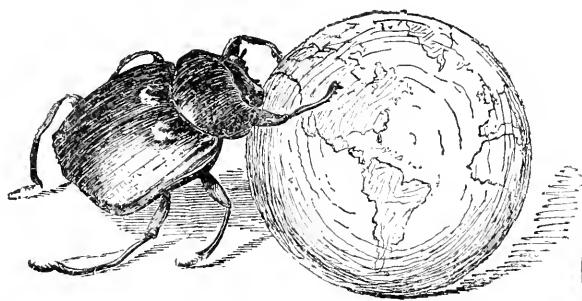
After discussion by Dr. Lutz, Mr. Pollard and Dr. Osburn the proposal was referred to the executive committee with a request to report thereon at the next meeting.

VOL XX.

No. 4.

JOURNAL
OF THE
NEW YORK
Entomological Society.

Devoted to Entomology in General.



DECEMBER, 1912.

Publication Committee.

F. E. LUTZ.

CHARLES SCHAEFFER

R. C. OSBURN.

W. M. WHEELER

Published Quarterly by the Society.

LANCASTER, PA.

NEW YORK CITY.

1912.

[Entered April 21, 1904, at Lancaster, Pa., as second-class matter, under Act of Congress of July 16, 1894.]

CONTENTS.

A Revision of the Genus *Brachypremna* Osten-Sacken.

By CHAS. P. ALEXANDER 225

Studies in Itonididae. By E. P. FELT 236

A Review of the North American Species of *Collops*. By H. C. FALL 249

Gall-Fly Parasites from California. By DANIEL T. FULLAWAY 274

Miscellaneous Notes and Descriptions of North American Geometridæ

By JOHN A. GROSSBECK 282

Miscellaneous Notes. 292

Proceedings of the New York Entomological Society. 295

◆◆◆

JOURNAL

OF THE

New York Entomological Society.

Published quarterly by the Society, at 41 North Queen St., Lancaster Pa., and New York City. All communications relating to the JOURNAL should be sent to the Publication Committee, New York Entomological Society, American Museum of Natural History, New York City; all subscriptions to the Treasurer, Wm. T. Davis, 146 Stuyvesant Place, New Brighton, Staten Is., New York, and all books and pamphlets to the Librarian, John A. Grossbeck, American Museum of Natural History, New York City. Terms for subscription, \$2.00 per year, strictly in advance. *Please make all checks, money-orders, or drafts payable to NEW YORK ENTOMOLOGICAL SOCIETY.*

Authors of each contribution to the JOURNAL shall be entitled to 25 separates of such contribution without change of form. If a larger number be desired they will be supplied at cost provided notice is sent to the Publication Committee before the page proof has been corrected.

JOURNAL

OF THE

New York Entomological Society.

VOL. XX.

DECEMBER, 1912.

No. 4.

A REVISION OF THE GENUS BRACHYPREMNA OSTEN SACKEN (TIPULIDÆ, DIPTERA).¹

BY CHAS. P. ALEXANDER,

ITHACA, N. Y.

The genus *BrachyPremna* was erected by Osten Sacken in 1886.² for *Tipula dispellens* Walker; at the same time *Tipula breviventris* Wiedemann was definitely referred to this genus. The following year,³ in part 2 of his "Studies on Tipulidæ," the same author described two new species, *pictipes* and *unicolor*, and gave a key (*l. c.*, p. 239) for the separation of the four known species. In 1900, Williston⁴ described the fifth species, *similis*. I have had for study some fifty specimens of *BrachyPremna* received from the various Eastern Museums, and in this material I found all of the known forms excepting *pictipes*. There was also included a new species, hereinafter described, and a single specimen of the hitherto unrecognized *Tipula albimana* of Wiedemann. This name is preoccupied by *T. albimana* Fabricius (Mantissa Ins., vol. 2, p. 232, 1787) and I propose the name *candida* for the South American species. The seven species at present known are separated by the included key. *BrachyPremna eocenica* Meunier was recently⁵ described from the baltic amber.

¹ Contribution from the Entomological Laboratory, Cornell University.

² Berl. Ent. Zeitschr., Vol. 30, p. 161.

³ Berl. Ent. Zeitschr., Vol. 31, pt. 2; pp. 239, 240.

⁴ Biologia Centrali-Americanæ, Dipt., Vol. 1, Supplement, p. 229.

⁵ Monograph of the Tipulidæ and Dixidæ in the Baltic Amber, Ann. Sci. Nat. Zoöl., Vol. 4, p. 394; pl. 16, fig. 6. (Paris, 1906.)

I am under obligations to Mr. E. T. Cresson, Jr., for the loan of the material in the Academy of Natural Sciences, Philadelphia; to Mr. Grossbeck for the American Museum forms; to Mr. Samuel Henshaw for the especially desired specimens of *Brachyptremna unicolor* from the Loew Collection, now in the Museum of Comparative Zoölogy, Cambridge; to Mr. Fred'k Knab for the extensive collections of the U. S. National Museum, collections which contained all of the six species that I have examined; to Dr. J. Chester Bradley for the Cornell University specimens, especially rich in *B. dispellens*, and to Mr. E. B. Williamson for some very interesting material, collected on the author's recent trip to British Guiana. I express my gratitude to all of the above gentlemen, and to others hereinafter mentioned.

CHARACTERS OF THE GENUS.

Head: rostrum elongated; nasus distinct, cylindrical, bearing a number of elongated hairs at its apex; maxillary palpi elongated; segments one and two short, subequal; segment three, half again as long as the second; last as long as two and three together; antennæ short; first segment cylindrical; second, globular; flagellar segments elongate-ovate, gradually more slender and elongated, bearing scattered hairs.

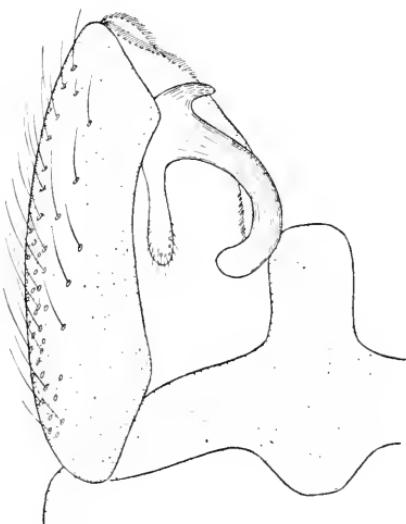
Thorax: pronotum and collare slender, distinct, so that the head is separated from the mesonotum; legs long and slender, the tarsi almost as long as the femora and tibiæ combined; hind tibiæ spurred; the fore and middle tibiæ apparently spurless.

Wing venation: *Sc* long, ending opposite (*unicolor*) or beyond the fork of *Rs*; *Rs* strongly arcuated at its origin, almost square but not spurred, longest in *unicolor*, shortest in *candida*; *R₂₊₃* of varying length, shortest, relatively, in *unicolor*, longest, relatively, in *candida*; crossvein *r* long connecting *R₂₊₃* at the fork; *R* very pale, vertical, basal deflection of *R₁₊₂* prominent in all the species excepting *unicolor*; cross-vein *r-m*, when present, always short; cross-vein *m* very long, forming the distal face of cell 1st *M₂*; petiole of cell *M₁* moderately long except in *unicolor* where it is very short; basal deflection of *Cu₁* slightly beyond the fork of *M*, except in *unicolor* where it is located at, or proximad of, the fork; fusion of *M₂* and *Cu₁* short, almost *nil* in *unicolor*, moderate in most species, longest in

candida; cell 1st M_2 large, subquadrate in all the species, except *unicolor* where it is almost triangular; 2d anal very short, straight, leaving cell 2d A very long and narrow.

From the above it will be seen that *unicolor* is the most distinct species, venationally, with *candida* second. The other species show a great similarity as regards the course of the veins; a character that I have used, should be explained; in the comparison between the length of the sector, beyond the strong basal arcuation, the straight portion of the vein is compared with that portion of $M_{1,2}$ lying between the cross-veins $r-m$ and m , i. e., cephalic margin of cell 1st M_2 (discal).

Abdomen: rather long and narrow. Hypopygium (see text fig-



Hypopygium of *BrachyPremna dispellens* Walk., dorsal aspect.

ure): margin of the 9th sternite convex with a broad, obtuse notch; pleural pieces elongate, cylindrical (in lateral outline, triangular); with a deep groove on the ventral face; outer face beset with long hairs; apical appendage, elongate, hairy, the basal half rather fleshy, the apical half chitinized; viewed from the side the chitinized tip is strongly curved with the tip flattened and rather expanded; on the outer side at the base of the chitin, is a stout conical tooth; on the inner face at the end of the fleshy portion of the arm is a fleshy,

elongated lobe, beset with stout hairs; the guard of the penis is short and stout; anal tube very short. In a position of rest, the appendages tightly fit into grooves on the ventral side of the pleural pieces.

Ovipositor of the female with the valves rather short, straight, pointed.

KEY TO THE SPECIES OF *Brachyfremna* O. S.

1. Basal deflection of R_{4+5} obliterated, so that R_{2+3} and R_{4+5} arise directly from the end of the radial sector; R_s elongate; cell 1st M_2 sub-triangular; legs uniform brown. (Antilles). *unicolor* O. S.
Basal deflection of R_{4+5} prominent; R_s shorter; cell 1st M_2 sub-quadrata; legs variegated with white or yellowish-white. 2
2. Femora with the tip dark, brownish-black. 3
Femora with the tip abruptly light-colored, white or yellowish-white. 5
3. Tibiae uniformly pale, whitish. (East U. S.-Brazil). *dispellens* Walker.
Tibiae more or less dark colored. 4
4. Tibiae white at the extreme base only. (Guiana, Brazil, Bolivia).
breviventris Wied.
Tibiae white at the base and tip. (Guiana-Brazil). *williamsoni*, n. sp.
5. Tip of tibiae broadly pale; tarsi pale. 6
Tip of tibiae and the tarsi dark, concolorous with remainder of the legs. (Mexico-Panama). *similis* Williston.
6. Tibiae with a narrow dark band, three mm. broad, situated one and one half mm. from the base. (Brazil). *pictipes* O. S.
Tibiae with the dark median band, broad, comprising about half the length of the segment. (Guiana-Brazil). *candida* n. n.

***Brachyfremna dispellens* Walker.**

1860. *Tipula dispellens* Walker, Trans. Ent. Soc. Lond., Vol. 5, new series, p. 334. 1878. *Tipula dispellens* Osten Sacken, Cat. Dipt. N. Am., ed. 2, p. 39. 1886. *Brachyfremna dispellens* Osten Sacken, Berl. Ent. Zeitschr., Vol. 30, p. 162. 1900. *Brachyfremna dispellens* Williston, Biol. Cent.-Amer., Dipt., Vol. 1, suppl., p. 229. 1909, *Brachyfremna dispellens* Johnson, Boston Soc. Nat. Hist. Proc., Vol. 34, p. 123.

Head: rostrum light brown, the nasus rather short, dark brown; palpi, basal segment dark brown; second, brown at the base, paler, yellowish-white, apically; third segment entirely pale; fourth segment dark brown. Antennæ, basal segments pale, flagellar segments light brown, the apices of the segments indistinctly paler. Front, vertex and occiput rather dark brown, except a very narrow, pale border adjoining the inner margin of the eye; center of the vertex clear-gray.

Thorax: prothoracic scutum pale, the lateral margins dark brown and two elongated spots on either side of the median line. Mesonotum, praescutum light brown, the extreme cephalic margin and the lateral edge, paler, whitish; a distinct narrow brown line, arcuated outwards at the cephalic margin of the sclerite,

thence continuing straight to the suture, the pale median line enclosed by them very narrow; sides of the sclerite dark brown, with an elongate, triangular, white mark, beginning on the lateral end of the suture before the wing-base, running inward; scutum light brown with three dark brown stripes, the median one broader; scutellum brown on the sides, in the middle silvery-white with an elongate brown median vitta; postnotum silvery-white, tri-vittate with dark brown, the pale stripes a trifle narrower than the dark median stripe. Pleure dull silvery-white, less clear anteriorly, with narrow dark brown stripes, the most dorsal of which begins at the prescutal pseudosutures (humeral pits), runs very obliquely under the bases of the wings and halteres and ends in the abdominal sternites; the second stripe is interrupted and includes the outer face of most of the coxae. Halteres: knob brown, stem pale. Legs: coxae gray with a distinct brown stripe; trochanter pale; fore and middle femora dark brown; hind femur light brown, darkening to the tip; tibiae and tarsi entirely pale yellowish-white.

Wings: subhyaline, costal cell light brown or gray; cell R_2 with the costal border brown; tip of cell R_3 narrowly brown on the caudal margin; veins conspicuously margined with brown; tips of the median veins and Cu_1 very pale; stigma pale brown, margined with blackish-brown. Venation (see Fig. b): R_s rather long, beyond the arcuation a little longer than M_{1+2} between cross-veins $r-m$ and m ; $r-m$ short, but distinct, basal deflection of Cu_1 beyond the fork of M ; fusion of Cu_1 and M_2 rather extensive.

Abdomen: tergum dark brown with indications of a paler, median, dorsal stripe; sternum very pale, the basal segments with oval dark brown spots in the middle, these fading out caudad into a lighter brown; in the distal segments, the dark brown spots become much more elongated. Hypopygium, see the generic characterization.

$\delta\delta$ (Vienna, Georgia), length, 11.5-15.8 mm.; wing, 15.2-19.6 mm. Fore leg, femur, 11.8 mm.; tibia, 13.5 mm. Hind leg, femur, 11.6-15 mm.; tibia, 12.6-17.2 mm.

σ (Igarape-Assu, Brazil), length, 13.8 mm.; wing, 18.1 mm. Fore leg, femur, 11.6 mm.; tibia, 13 mm. Hind leg, femur, 13.9 mm.; tibia, 15.5 mm.

φ (Igarape-Assu, Brazil), length, about 15.8 mm.; wing, 16.8 mm. Fore leg, femur, 11.2 mm.; tibia, 12 mm. Hind leg, femur, 12.8 mm.; tibia, 14.1 mm.

Distribution.—United States: New Jersey, Shark River, Monmouth Co. (Johnson); District of Columbia, Washington (Osten Sacken); North Carolina, Pendleton, Northampton Co. (Johnson); Kentucky, in Mus. Comp. Zoöl. (Johnson); Georgia, Atlanta, Felton Co.; Vienna, Dooly Co., Albany, Dougherty Co., Bainbridge, Decatur Co. (Dr. J. C. Bradley), and Billy's Island, Okeefinokee Swamp, Charleston Co. (Cornell University Exped. 1912); Florida, Tick Island, Volusia Co. (Johnson), Jacksonville, Duval Co. (Johnson); Texas, Dallas, Dallas Co. (Boll). Mexico: Tabasco, Teapa and

Frontero (H. H. Smith); Vera Cruz, Medellin (H. H. Smith); Isthmus of Tehuantepec (Sumichrast). Cent. Am.: Guatemala, Antigua (Eisen), Aguna (Eisen). Antilles: Trinidad (Busck), Cunapo River, Trinidad (Williamson). Dutch Guiana (authority Osten Sacken; Berl. Ent. Zeit., vol. 31, p. 239). Brazil: Para, Igarapé-Assú (Parish).

B. dispellens is readily distinguished from all of its allies by the uniform pale tibiae. Northern specimens (Georgia) seem to have the coloration clearer cut, the pattern more grayish. Specimens from Guatemala have the costal cell of the wings more yellowish-brown; cell R_2 brown in the middle, paler along the costal margin; the tibiæ and tarsi more yellowish-white, etc. However, the Brazilian material shows almost the same type of coloration as the Georgia specimens and the discrepancy in color must be attributed to the age of the specimens and other factors.

Brachypremna breviventris Wiedemann.

1821. *Tipula breviventris* Wied., Dipt. Exot., Vol. 1, p. 43. 1828. *Tipula breviventris* Wied., Aussereur. Zweifl. Insekt., Vol. 1, p. 47. 1886. *Brachypremna breviventris* Osten Sacken, Berl. Ent. Zeit., Vol. 30, p. 161. 1900. *Brachypremna breviventris* Hunter, Trans. Am. Ent. Soc., Vol. 26, p. 285. 1902. *Brachypremna breviventris* Kertesz, Cat. Dipt., Vol. 2, p. 264.

Head: rostrum brown, shiny; nasus black, tipped with yellow hairs; palpi, basal segment yellow; second dark brown, tipped with pale brown; remaining segments dark brown. Antennæ, basal four or five segments light yellow; remainder gradually darker, brown. Front light cream-color, vertex and occiput brown with a sparse yellow bloom.

Thorax: light brown, mesothoracie præsentum with a narrow brown stripe on either side of the very narrow median pale stripe; a short broad dark stripe beginning just behind the proximal end of the pseudo-sutural fovea, broadening out behind, somewhat interrupted at the suture; scutum dark brown on the lobes, this color a continuation of the lateral præscutal stripes, scutum pale medially; scutellum pale with a short, double, brown median line; post-notum brown, with two narrow pale stripes on either side, these being a continuation of the pale vitte on the scutellum. Pleuræ brown anteriorly, the meso- and meta-pleuræ with a gray bloom; the sclerites with brown margins giving the pleuræ a spotted appearance. Halteres: stem pale, knob brown. Legs: coxæ dark brownish with a large pale spot on the outer face; trochanter yellow; femora light yellowish-brown, darkening at the tip to a brownish-black; tibia with the extreme base, abruptly yellowish-white; remainder of the tibiæ dark brown; base of the metatarsus dark brown, concolorous with the tibia, the remainder of the tarsi brightening to a yellowish-brown.

Wings: costal cell brownish; remainder of the wing sub-hyaline; cell R_1

largely pale brown; cell R_2 with the extreme cephalic margin pale yellow, running down and ending at a drop in the end of cell R_3 ; cell R_2 brown, with the caudal margin sub-hyaline; end of cell R_3 dark with the yellowish spot above described; R_5 dark at tip with a hyaline drop in the outer caudal angle; cell M_1 almost hyaline; veins with narrow brown seams; stigma usually with a large sub-hyaline spot in under r , sometimes small or absent. Venation (see Fig. *d*): R_s rather long, beyond the arcuation longer than M_{1+2} between cross-veins $r-m$ and m ; basal deflection of Cu_1 beyond the fork of M .

Abdomen: tergum brown, extreme bases of the segments, pale yellowish; sternum light brownish-yellow with a distinct elongate-ovate black spot in the middle of each segment.

δ . wing, 21 mm. Fore femur, 12.7 mm.; fore tibia, 14 mm.

$\varphi\varphi$, length, 17.4-17.9 mm.; wing, 18-18.8 mm.; fore leg, femur, 11.3-11.6 mm.; tibia, 13-14.5 mm.; hind leg, femur, 13.2-13.8 mm.; tibia, 13.6-14.9 mm.

Distribution.—Dutch Guiana: Cigi Makoe (H. Polak), Paramaribo (Miss Mayo). Brazil: Igarapé-Assú, State of Para (Parish), Rio Blanco (H. H. Smith).

B. breviventris may be readily distinguished by its dark femoral and tibial tips and pale basal tibial ring.

Brachypremna williamsoni, new species.

Tip of femur dark; base and tip of tibia abruptly light colored; wings tinged with darker.

$\delta\delta$, length, 11.3-15.7 mm.; wing, 14.8-19.3 mm. Fore leg, femur, 10 mm.; tibia, 11.4 mm. (paratype No. 1).

Head: rostrum brown; palpi, basal segment mostly black, second yellow at extreme base and tip, remaining segments brownish-black. Antennæ, basal segments, pale brown; second, light yellow; flagellar segments with the base brown, tip yellowish, the brown increasing on the outer segments. Front brown; vertex and occiput light brown, brighter colored adjoining the eye.

Thorax: rather similar to *breviventris*, the long intermediate brown stripes quite indistinct; post-notum with the median brown stripe divided by a pale median line. Pleurae without distinct brown spots. Halteres: base of stem pale, thence gradually darkening to the brown knob. Legs: coxae grayish-yellow, indistinctly spotted with brown; femora brown, not darkened at the tip as in *breviventris*; tibia dark brown, a narrow ring at base and tip, pale yellowish-white, tarsi brown, lighter colored toward the tip.

Wings: conspicuously tinged with darker; costal cells brown; cell R_2 with a brown cloud in cephalic portion and a hyaline droplet near outer end; R_3 dark at outer end with a sub-apical hyaline spot; R_5 similar with a conspicuous rounded drop; M_1 , cephalic margin of tip brown, caudal margin of tip with a hyaline drop; cell M_1 dark, not hyaline, as in *breviventris*; veins with narrow seams of darker brown; stigma brown, a pale spot in it just below cross-vein r ; (in the type δ , stigma clear brown). Venation (see Fig. *e*): R_s beyond

arcuation short, scarcely longer than M_{1+2} between cross-veins $r-m$ and m ; basal deflection of Cu_1 before the middle of cell 1st M_2 .

Abdomen: tergum brown, the base of the sclerite paler, more yellowish; sternum pale, the median markings pale brown, broadly ovate, not elongate or black.

Paratype No. 1 differs in having the tibiae unicolorous throughout, dark brown.

Paratype No. 2 has the tarsi much lighter, yellowish.

Paratype No. 3 is much larger (largest measurements given).

Holotype, ♂, Wismar, British Guiana. (Williamson, Coll.) Jan. 30, 1912.

Type in author's collection.

Paratype No. 1, ♂, with the type.

Paratype No. 2, Paramaribo, Dutch Guiana. (Miss Mayo.) (In Coll. Acad. Nat. Sci. Phil.)

Paratype No. 3, Manaos, State of Amazonas, Brazil. (Miss Merrill.) (In Coll. U. S. Nat. Mus.)

B. williamsoni is a small species finding its nearest relative, apparently, in *brevitentris* Wied. It differs from this species in the pale tibial tips; the oval brown markings on the abdominal sternites (these being linear and brownish-black in *brevitentris* and most other species), and in different wing-pattern. I take pleasure in naming this interesting form after Mr. E. B. Williamson, of Bluffton, Indiana, who collected the types while in Guiana in 1912, in search of Odonata.

Brachyptremna similis Williston.

1900. *Brachyptremna similis* Will., Biol. Cent.-Amer., Dipt. 1, Supplement, p. 229. 1902. *Brachyptremna similis* Kertesz, Cat. Dipt., Vol. 2, p. 265.

Head: rostrum, light brownish-yellow, darker on the side; nasus brown with brownish-yellow hairs; palpi mostly brown, in some specimens the two basal segments are light yellow. Antennae with the basal segments pale, yellowish; segments three to five, brown at base, pale at apex; remainder of the antenna brown. Front, vertex and occiput dark brown, except a narrow yellow margin immediately adjoining the eyes.

Thorax: praescutum usually with the pale narrow median stripe not distinct (in some specimens it is apparent behind, in the vicinity of the suture), the pale stripes separating the broad lateral stripes from the median vitta are narrow and ill-defined; scutum dark brown on the lobes, paler medially; postnotum with the median brown vitta broad, the adjoining pale stripes very narrow. Pleurae pale, spotted with brown, these brown marks being on the margin of the sclerites. Halteres brown, the root of the stem paler. Legs:

coxae pale, yellowish-white; femora brown, darkening outwardly, the tip abruptly pale yellowish-white; tibiae with a basal ring, subequal in width and of the same color as the femoral band; remainder of the tibiae dark brown; tarsi brown, the apical segments becoming paler, yellowish-brown.

Wings: costal cell yellowish-brown; cell R_2 almost clear, more yellowish on the costal margin; outer end of cell R_3 narrowly blackish-brown on the caudal margin; cell R_3 dark brown with a rounded hyaline drop; cell M_1 almost hyaline, with a large oval, even clearer, drop at its end; veins very indistinctly margined with darker; stigma dark brown, paler in the center. Venation (see Fig. a): R_s rather short, beyond the arcuation, a little longer than M_{1+2} between r_m and m ; r_m a little more distinct than is usual in the genus; basal deflection of Cu_1 just beyond the fork of M .

Abdomen: tergum dark brown, the extreme base of the segments paler, less distinct on the apical segments; sternum light brown with an elongate blackish spot in the middle of each segment; hypopygium rather browner than in related species.

♂, length, 15.2 mm.; wing, 18.4–20 mm. Fore leg, femur, 12.1 mm.; tibia, 14.3 mm. Hind leg, femur, 14.8 mm.; tibia, 15.9 mm.

♀, length about 15 mm.; wing, 16.6 mm. Fore leg, femur, 11 mm.; tibia, 13 mm. Hind leg, femur, 12.7 mm.; tibia, 14.6 mm.

Distribution.—Mexico, Teapa in Tabasco (H. H. Smith); Guatemala, Livingston (Schwarz-Barber); Nicaragua, Escondido R., 50 miles from Bluefields (Richmond); Panama, Gatun (Jennings), Porto Bello (Buseck), Paraiso (Buseck).

Distinguished from the other species with pale femoral tips, *candida* and *pictipes*, by the dark tibial apices.

Brachypremna candida, new name.

1830. *Tipula albimana* Wied., Aussereur Zweifl. Insekt., Vol. 2, p. 615. non *T. albimana* Fab. 1900. *Tipula albimana* Hunter, Trans. Am. Ent. Soc., Vol. 26, p. 286. 1902. *Tipula albimana* Kertesz, Cat. Dipt., Vol. 2, p. 281.

Head: rostrum yellowish; nasus pale with pale hairs; palpi, first segment dark brown; second segment mainly yellowish; remainder black. Antennæ, first two segments yellowish, remainder dark brown. Front, vertex and occiput pale with a gray bloom.

Thorax: praescutal stripes about as in *breviventris*, but very indistinct; the usually distinct markings of the mesothoracic scutellum and postnotum not at all evident. Pleure brown, without distinct markings. Halteres brown, extreme base of the stem pale. Legs: femora brownish-yellow at base, gradually darkening to brown, with a rather broad, apical yellow ring; tibia with a basal yellow band about as wide as the femoral; apice of the tibia more or less yellowish-white, broadest on the hind leg, where it covers nearly one half of the segment; tarsi pale yellowish-white.

Wings: almost hyaline, cell C only a little more yellowish than the rest of

the wing; wing tip suffused with brown; inner end of cell R_2 , adjoining vein R_2 , pale, hyaline; remainder of cell R_2 , most of R_3 and outer end of R_5 , uniformly brown, without hyaline droplets as in most of the species; veins rather indistinctly seamed with darker color; stigma dark brown, uniform. Venation (see Fig. f) : R_s very strongly arcuated, beyond the arcuation, R_s is shorter than M_{1+2} between the cross-veins $r-m$ and m ; fusion of M_3 and Cu_1 extensive, longer than R_2 .

Abdomen: tergum brown, segments paler basally, rather darker apically; 8th segment brownish-black; hypopygium pale; sternites not visible in the single specimen before me.

♂, length, 12 mm.; wing, 14.2 mm. Hind leg, femur, 13 mm.; tibia, 15.6 mm.

Distribution.—Dutch Guiana (Wiedemann's type); Brazil (Manaos, State of Amazonas) (Miss Merrill, Coll.). Specimen in U. S. Nat. Mus. Coll.

This small species is conspicuously different from the nearest related species in its wing and leg pattern. The lack of hyaline droplets in the ends of the radial cells distinguishes it from *similis*, *breviventris* and *williamsoni*. The leg pattern is closest to *pictipes*, but I cannot believe the two species to be conspecific. *Pictipes* is larger, and the dark tibial band is only 3 mm. broad; *candida* is our smallest species and the tibial band is broad, narrowest on the hind legs (6 mm.) and very wide on the fore legs (12 mm.).

Brachypremna pictipes Osten Sacken.

1887. *Brachypremna pictipes* O. S., Berl. Ent. Zeitschr., Vol. 31, pt. 2, p. 239.

1900. *Brachypremna pictipes* Hunter, Trans. Am. Ent. Soc., Vol. 26, p. 285.

1902. *Brachypremna pictipes* Kertesz, Cat. Dipt., Vol. 2, p. 265.

♂.—Front and vertex brownish, paler in the middle; antennæ brownish, two basal segments yellow; rostrum yellowish above, brown below; palpi brown at base and tip but yellow in the middle. Ground color of thorax brownish-yellow; collar with a short double longitudinal stripe in the middle and a lateral brown spot on each side; mesonotum with a double brown intermediate stripe and short, broad lateral stripes; metanotum pale with three brown stripes; some brown spots on the pleuræ. Abdomen brown above, with a very faint longitudinal stripe on the basal segments; venter yellowish with a brown streak in the middle of each segment, forming an interrupted longitudinal stripe; male genitalia, small, yellowish. Halteres brownish, paler at bases. Femora brownish, the tip yellowish-white for about 1.5 mm.; tibiae and tarsi yellowish-white except a brown ring on the tibiae, about 3 mm. broad placed at about 1.5 mm. from the knee, the interval being white. Wings with a uniformly pale brownish tinge, the stigma but slightly darker; venation like *B. breviventris* Wied. L. 16-18 mm.

Hab. Cassapava, Brazil. (Sellow, Coll.)

"Type in Berlin Museum."

Adapted from Osten Sacken's original description, *l. c.*, p. 239.

BrachyPremna unicolor Osten Sacken.

1887. *BrachyPremna unicolor* O. S., Berl. Ent. Zeit., Vol. 31, pt. 2, pp. 239-240.

1900. *BrachyPremna unicolor* Hunter, Trans. Am. Ent. Soc., Vol. 26, p. 285.

1902. *BrachyPremna unicolor* Kertesz, Cat. Dipt., Vol. 2, p. 265.

Head: rostrum light brown; nasus concolorous, with short hairs; palpi, basal segment, brownish at origin, paler apically; second segment pale; remaining segments brown. Antennæ, first segment brown; second segment much lighter colored, yellow; flagellar segments dark brown with the extreme tip yellow, producing an annulated appearance, this coloring becoming obsolete near the end of the flagellum. Front, vertex and occiput light yellowish-brown.

Thorax: præscutum light brown, the anterior portion of the sclerite suffused with brownish, concealing the usual stripes; two distinct brown dots on the extreme cephalic margin of the sclerite; on the caudal portion of the sclerite, the dark stripes become distinct; median dark stripe not double; scutum uniformly light brown with suggestions of darker lines; scutellum and postnotum pale, with a narrow brown median line and with the lateral edges of the sclerite indistinctly brown. Pleuræ uniformly pale without distinct darker marks. Halteres long, brown, pale at the base of the stem. Legs: coxae pale, femora light brown passing into dark brown at the tip; tibia dark brown, the extreme base slightly paler, but not producing a ringed appearance; tarsi slightly lighter brown.

Wings: almost hyaline; cell C light yellowish-brown or yellow; cell R_2 tinged with yellow along the costal margin; cell R_3 tinged with yellow at the tip; veins narrowly margined with pale brown; darker brown clouds at the ends of the radial veins; stigma very pale brown with a narrow border of darker brown. Venation (see Fig. c): R_s long, beyond the areuation, about three times as long as M_{1+2} between cross-veins $r-m$ and m ; basal deflection of R_{4+5} none, so that R_{4+5} is in a line with R_s and R_{2+3} and R_{4+5} arise directly from the end of the sector; cross-vein $r-m$ short but distinct, petiole of cell M_1 very short; cell 1st M_2 sub-triangular; fusion of M_3 and Cu_1 very slight; basal deflection of Cu_1 at, or before, the fork of M .

Abdomen: tergum dark brown, the bases and lateral margin of the segments indistinctly paler; sternum pale, with the median spots on the segments very elongate, black, forming an almost continuous line; lateral margins of the sclerites, darker, brownish.

♀, length, 16.5-18.6 mm.; wing, 18.5-20.1 mm. Fore leg, femur, 11.8 mm.; tibia, 13.3 mm. Hind leg, femur, 13.8-14 mm.; tibia, 15.4-16 mm.

Distribution.—Island of Cuba, Cayamas (E. A. Schwarz); Island of Porto Rico (Moritz) Osten Sacken's types; Island of Grenada, Lesser Antilles (Busck.).

This remarkably distinct species requires little comparison with the other forms at present known. The plain brown tibiæ and the remarkable venation will serve to distinguish the species at a glance.

EXPLANATION OF PLATE XVI.

- These figures show the venation, and the main features of color-pattern.
a, wing of *Brachyfremna similis* Williston.
b, wing of *Brachyfremna dispellens* Walker.
c, wing of *Brachyfremna unicolor* Osten Sacken.
d, wing of *Brachyfremna breviventris* Wiedemann.
e, wing of *Brachyfremna williamsoni*, n. sp.
f, wing of *Brachyfremna candida*, n. n.
-

STUDIES IN ITONIDIDÆ.

BY E. P. FELT,

ALBANY, N. Y.

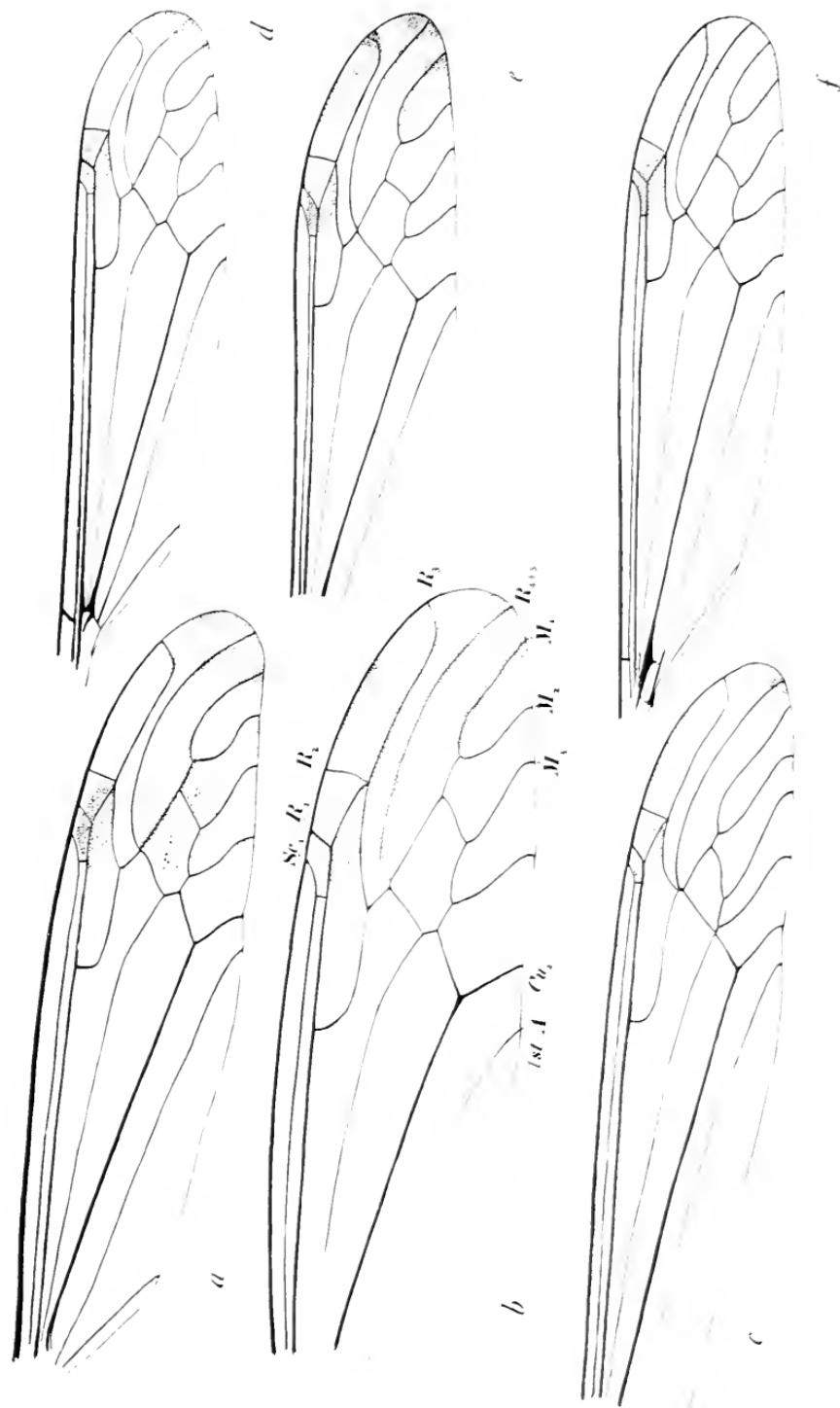
Below we erect two new genera, describe a number of new species and establish more fully the identity of one of the earlier described forms. The last is to us more satisfactory than characterizing new genera or new species. There are a multitude of forms in this family of minute flies and much biological and systematic awaits the investigator. References to the genus *Dicrodiplossis* must be considered provisional, since we have placed in this group a number of dissimilar forms, some of which are hardly cogeneric, because we deem it unwise to attempt a division of the species till more abundant data are available.

NEOCATOCHA, new genus.

This remarkable form has the venation of *Catocha* and the greatly reduced antennæ of *Microcerata*, from which latter it is easily distinguished by the normal second antennal segment. The short, sessile, flagellate antennal segments and the characteristic venation serve to separate this genus from *Neptunimyia*. The type species is *N. marilandica* n. sp.

Neocatocha marilandica, new species.

Female.—Length 1.75 mm. Antennæ short, dark brown; 8 segments, the



first and second normal, the fifth sessile, subglobose, with a length slightly greater than its diameter, irregularly and sparsely clothed with short setæ and subapically with a whorl of probably four short, stout, fleshy appendages; terminal segment compound, composed of three closely fused, and with a length about four times its greatest diameter. Palpi: first segment irregularly quadrate, the second and third subequal, each with a length $2\frac{1}{2}$ times the diameter, the fourth a little longer, more slender. Eyes moderate, black, coarsely granulate; ocelli present. Mesonotum dark reddish brown. Scutellum yellowish brown, postscutellum slightly darker. Abdomen mostly dark yellowish brown. Wings hyaline. Halteres yellowish brown. Legs mostly dark yellowish brown; claws moderately stout, strongly curved, simple, the pulvilli as long as the claws. Ovipositor short, the lobes triarticulate, the distal segment suborbicular. Ventrally, on the 9th segment, there is a pair of submedian, fuscous, pyriform appendages. Type C. 1390.

One female was taken by Dr. W. L. McAtee on Plummers Island, Maryland, March 24, 1907.

NEPTUNIMYIA, new genus.

This genus is erected for a unique form representing an intermediate stage in development between *Lestremia* and the highly reduced antennal structures of *Microocrata* and *Tritozyga*. It is more closely allied to the former though easily separated therefrom by the normal second antennal segment, the tridentate antennal appendages and the stoutly pectinate claws. The type species is *N. tridens* n. sp.

Neptunimyia tridens, new species.

Female.—Length 2.75 mm. Antennæ hardly extending to the base of the abdomen, sparsely haired, fuscous yellowish, the basal segments yellowish; 9 to 11 segments, the first obconic, the second short, subglobose, not enlarged, the fifth fusiform, with a length $2\frac{1}{2}$ times its diameter, a sparse, subbasal whorl of stout setæ and subapically a whorl of two or more irregularly tri- or quadridentate sensory structures; terminal segment narrowly conical, with a length three times its diameter and tapering uniformly to an obtuse apex. Palpi quadriarticulate, yellowish white, nearly as long as the antennæ, the first segment with a length about three times its diameter, somewhat swollen distally, the following segments, each about $\frac{1}{2}$ longer and more slender than the preceding. Eyes brownish black. Mesonotum dark brown, sparsely haired. Scutellum yellowish brown, postscutellum fuscous yellowish, dark brown posteriorly. Abdomen fuscous yellowish, the incisures and pleura dull yellowish orange. Ovipositor fuscous yellowish. Wings hyaline, costa dark brown, subcosta uniting therewith at the basal third; the third vein, broadly and closely united to subcosta at its distal sixth, joins the margin at the distal fourth; the slender fourth vein

arises from the third vein near its union with subcosta, branches near the middle of the wing, the anterior fork joining the margin at the apex of the wing, the posterior branch nearly midway between the anterior fork and the simple fifth vein, which latter unites with the posterior margin at the distal fourth, the sixth near the basal half; membrane rather thickly clothed with relatively long hairs. Halteres dull fuscous yellowish. Coxæ dull yellowish, the femora basally yellowish straw, the distal portion fuscous yellowish; tibiae and tarsi darker; claws stout, strongly curved, the concavity stoutly pectinate; pulvilli nearly as long as the claws. Ovipositor short, apparently biarticulate, the first segment irregularly triangular, the second narrowly oval, both thickly setose.

Exuvia.—Length 1.5 mm., whitish transparent, the short antennal cases moderately stout, the wing pads extending to about the fourth abdominal segment, the anterior margin in particular being fuscous, the leg cases reaching to the tip of the abdomen; the thorax dorsally, and pleuræ with a few scattering, long, slender setæ, the surface of the abdomen with numerous transverse lines of microscopic denticulations. Type Cecid a1495a.

The unique female described above was reared April 17, 1911, from a jar containing maple leaves infested last year with the larva of *Cecidomyia ocellaris* O. S. It is possible that the insect developed from the very slight amount of decaying organic matter brought in with the sand. We are unwilling to believe that it is the parent of the semitransparent larvae producing in midsummer the numerous ocellate galls on soft maple leaves.

Porricondyla dorsata, new species.

Female.—Length 2.5 mm. Antennæ nearly as long as the body, light brown, sparsely haired; 12 segments, the fifth with a stem $\frac{1}{2}$ the length of the cylindric basal enlargement, which latter has a length four times its diameter; terminal segment produced, with a length nearly five times its diameter, irregularly obtuse apically. Palpi: first and second segments subequal, each with a length about three times the diameter, the third $\frac{1}{2}$ longer than the second, the fourth $\frac{1}{2}$ longer than the third. Mesonotum almost black. Scutellum yellowish orange, postscutellum yellowish brown. Abdomen reddish brown, the pleuræ yellowish orange, costa light straw. Halteres yellowish orange. Coxæ and femora pale straw; tibiae and tarsi fuscous straw; claws slender, evenly curved, unidentate, the pulvilli a little shorter than the claws. Ovipositor lobes narrowly and irregularly oval, sparsely setose. Type Cecid a2349.

The midge described above was taken by Mr. D. B. Young at Dug Mountain in the Adirondacks, August 8, 1912. It is easily separated from other American species of *Porricondyla*, having 12 antennal segments, by the longer stem of the fifth segment.

Porricondyla juvenalis, new species.

Male.—Length 1 mm. Antennæ probably over twice the length of the body, sparsely haired, at least 11 and probably 16 segments, the fifth with a yellowish stem $2\frac{1}{2}$ times the length of the basal enlargement, which latter is dark brown and has a length twice its diameter. Palpi: first segment slender, with a length four times its diameter, the second as long as the first, a little stouter, the third a little longer than the second, more slender, the fourth $\frac{1}{2}$ longer than the third. Mesonotum dark reddish brown. Scutellum reddish white, postscutellum brownish yellow. Abdomen dark yellowish brown, the genitalia fuscous yellowish. Wings hyaline, halteres pale yellowish, reddish brown apically. Coxæ and femora basally mostly pale yellowish, the femora apically and tibiae dark straw; tarsi fuscous. Genitalia: basal clasp segment quadrate; terminal clasp segment short, greatly swollen, heavily spined apically; dorsal plate long, broad, triangularly emarginate, the lobes obliquely truncate, setose; ventral plate moderately long, broad, deeply and roundly emarginate, the lobes narrowly rounded, setose. Harpes slender, lance-like, the strongly chitinized apex recurved. Type Cecid a2350.

The interesting form characterized above was taken by Mr. D. B. Young at Elm Lake in the Adirondacks, N. Y., August 7, 1912. It is remarkable because of the greatly prolonged antennal segments and is easily separated from the allied *P. flava* Felt by the lancet-like, recurved harpes.

Rhabdophaga aceris Shimer.

1868. Shimer, Henry, Amer. Ent. Soc. Trans., 1: 281-83 (*Cecidomyia*).
 1905. Washburn, F. L., Minn. Agric. Exp't. Sta. Bul. 93, p. 65 (*Cecidomyia*).
 1906. Felt, E. P., N. Y. St. Mus. Mem., 8, 2: 728 (*Cecidomyia*).
 1911. ———, Econ. Ent. Journ., 4: 452 (*Cecidomyia*).

Male.—Length 1.5 mm. Antennæ as long as the body, sparsely haired, fuscous yellowish; 15 segments, the fifth with a stem $\frac{3}{4}$ the length of the cylindric basal enlargement, which latter has a length $\frac{1}{2}$ greater than its diameter. Palpi: first segment short, irregular, second irregularly oval, third a little longer and more slender than the second, the fourth $\frac{1}{2}$ longer than the second. Mesonotum dark brown or blackish. Scutellum and postscutellum fuscous yellowish. Abdomen dark brown; genitalia fuscous yellowish. Legs probably fuscous yellowish, the tarsi darker; claws moderately stout, strongly curved, the pulvilli a little shorter than the claws. Genitalia: dorsal plate divided, the lobes narrowly rounded; ventral plate deeply and triangularly emarginate, the harpes broad, the heavily chitinized apex irregularly and coarsely dentate.

Female.—Length 2 mm. Antennæ extending to the third abdominal segment, sparsely haired, fuscous yellowish; 15 sessile segments, the fifth with a length twice its diameter. Abdomen probably reddish brown, ovipositor nearly as long as the abdomen; terminal lobes with a length over twice the width, irregularly and narrowly rounded apically. Other characters nearly as in the male. a2344.

The midge was reared by Dr. Shimer in midsummer from pale or whitish larvæ on the surface of white or silver maple leaves, *Acer saccharinum*. Dr. Shimer states that this species produces whitish cocoons upon the leaves, the midges emerging therefrom a week or two later. We have referred the midges reared from soft maple by J. S. Houser, of the Agricultural Experiment Station, Wooster, Ohio, August 9 and 26, 1912, to this species, and in order to establish its identity more fully give below descriptions of both sexes. The species is closely related to *R. rileyana* Felt, the latter being most easily distinguished by the long fourth palpal segment, it having a length twice that of the third. A study of a large series may show *R. rileyana* to be only a variety of Shimer's species.

Phytophaga ulmi Beutm.

Male.—Length 1.5 mm. Antennæ nearly as long as the body, sparsely haired, dark brown; 14 segments, the fifth with a stem as long as the cylindric basal enlargement, which latter has a length twice its diameter and a thick subapical whorl of long, stout setæ; terminal segment produced, with a length thrice its diameter, strongly tapering apically. Palpi whitish transparent, first segment irregular, subquadrate, the second with a length over twice its diameter, the third over $\frac{1}{2}$ longer than the second, the fourth a little longer than the third. Face fuscous yellowish. Mesonotum yellowish brown, the submedian lines sparsely haired. Scutellum reddish brown, postscutellum fuscous yellowish. Abdomen reddish orange, the dorsal sclerites fuscous. Wings hyaline, costa dark brown. Halteres yellowish transparent, fuscous apically. Coxæ fuscous yellowish, the legs mostly dark brown, the distal tarsal segments darker. Claws slender, strongly curved, the pulvilli as long as the claws. Genitalia: dorsal plate deeply and triangularly emarginate, the ventral plate broad, broadly and roundly emarginate.

Described from a specimen reared June 6, 1912, from galls collected at New Baltimore, N. Y., a1683. This sex was previously unknown. A full description of the female and an account of the species will appear in the writer's monograph of the Itonididae, now in manuscript.

Contarinia coloradensis, new species.

Gall.—Length 1.25 cm., diameter 1 cm. A budlike deformity covered with brownish scales and in one instance with rudimentary needles.

Larva.—Length 3 mm., moderately stout, a variable yellowish orange. Head small, the antennæ short, stout, unidentate. There is a distinct fuscous ocular spot just behind the head and a well-developed bidentate, somewhat irregular breastbone. Skin coarsely shagreened, the posterior extremity rounded and with a pair of submedian conical brownish tubercles.

Pupa.—Length 2.75 mm., stout, a variable reddish or yellowish, the thoracic horns rather slender. Antennal cases extending to the first abdominal segment. Wing cases to the third, and the longest leg cases to the fifth abdominal segment, each of the latter dorsally margined posteriorly with an irregular row of rather long, stout spines.

Female.—Length 2.5 mm. Antennæ extending to the third abdominal segment, sparsely haired, dark brown, lighter distally; 14 segments, the fifth with a stem $\frac{1}{4}$ the length of the cylindric basal enlargement, which latter has a length $2\frac{1}{4}$ times its diameter, sparse subbasal and subapical whorls of stout setæ and distinct circumfili; terminal segment somewhat reduced, obtuse apically. Palpi yellowish, first segment irregular, the second subquadrate, with a length $\frac{1}{2}$ greater than its diameter, the third nearly twice the length of the second, slender, the fourth about as long as the third, slightly dilated apically. Mesonotum slaty brown, the submedian lines thickly haired. Scutellum and postscutellum reddish brown, abdomen yellowish brown, the fifth and sixth segments somewhat lighter, the incisures fuscous yellowish, yellowish apically. Costa fuscous yellowish. Halteres fuscous yellowish, fuscous subapically. Coxæ and femora basally fuscous yellowish, the distal portion of femora, tibiae and tarsi mostly fuscous, the simple claw stout and a little shorter than the pulvilli. Ovipositor filiform, as long as the body, the terminal lobes slender, tapering, with a length five times the width. Type Cecid a2205a.

A large, budlike deformity on *Pinus scopulorum* was received from Prof. E. Bethel, Denver, Col., July 24, 1911, and the same gall from Prof. C. P. Gillette, of Fort Collins, Col. A species of *Dicrodiplosis*, *D. gillettei*, was reared from this gall and also another midge, probably a species of *Contarinia*, which latter is described above and is presumably the maker of the gall.

Thecodiplosis dulichii, new species.

Male.—Length 1.75 mm. Antennæ a little longer than the body, thickly haired, dark brown; 14 segments, the 3d to 11th binodose, the 5th having the stems with a length $1\frac{1}{2}$ and $3\frac{1}{2}$ times their diameters, respectively. Basal enlargement subglobose, distal enlargement subcylindric, with a length twice its diameter, each with a very short, subapical circumfilium, the distal enlargement with a rather thick subapical whorl of stout setæ, and a scattering subbasal whorl of finer setæ; 12th segment with the enlargement scarcely constricted at the basal third, the 13th and 14th each with a subcylindric basal enlargement, having a length about three times the diameter, and a distal stem about $\frac{3}{4}$ the length of the enlargement. Palpi: first segment irregular, with a length twice its diameter, the second twice as long as the first, the third a little longer than the second, more slender, the fourth $\frac{1}{2}$ longer than the third, slender. Mesonotum brownish red. Scutellum dark red, postscutellum and abdomen reddish orange. Genitalia yellowish orange. Wings hyaline, costa light brown. Halteres yellowish basally, reddish brown apically. Coxæ mostly yellowish orange,

the legs mostly dark brown; claws simple, curved at nearly right angles, greatly swollen subapically, the pulvilli about as long as the claws. Genitalia: basal clasp segment with a large triangular basal lobe internally; terminal clasp segment long, stout, slightly swollen basally; dorsal plate short, broadly and triangularly emarginate and mesially with a moderately deep, narrow incision; ventral plate long, broad, tapering, broadly and roundly emarginate; style long, stout.

Female.—Length 2 mm. Antennæ nearly as long as the body, sparsely haired, fuscous yellowish; 14 segments, the fifth with a stem $\frac{3}{4}$ the length of the cylindric basal enlargement, which latter has a length thrice its diameter; terminal segment produced, the basal enlargement with a length five times its diameter; apically there is a slender, hairy process about $\frac{3}{4}$ the length of the enlargement. Palpi: first segment irregularly subquadrate, the second with a length three times its diameter, the third a little shorter, the fourth $\frac{1}{2}$ longer than the third. Mesonotum yellowish brown, the submedian lines sparsely haired. Scutellum pale orange, postscutellum yellowish. Abdomen yellowish orange. Wings hyaline, costa light straw. Halteres yellowish basally, fuscous apically. Coxæ yellowish, the legs mostly dark brown, the distal tarsal segments especially on the anterior legs, yellowish brown. Ovipositor short, the terminal lobes with a length nearly twice the diameter, broadly rounded apically. Type a.2219.

Two males were reared June 3 and 4, 1912, from fruit of *Dulichium arundinaceum* infested by an orange-colored larva some 2 mm. in length and collected in August, 1911, by Miss Cora H. Clarke, Magnolia, Mass. The species is exceedingly interesting because of the extremely short circumfili, the produced distal enlargement and the gradual transition from the binodose to a cylindric stemmed condition in the distal antennal segments. It is allied to *T. mosellana* Gehin and *T. hudsonici* Felt, from which it may be separated by the moderate length of the basal portion of the stem of the 5th antennal segment. A species of *Lestodiplosis* was also reared from this material.

Thecodiplosis ananassi Riley.

The development of the gall is extremely interesting, as evidenced by material received from Marksville, La., from Dr. W. L. McAtee under date of September 12, 1912. The galls appear to originate in small, globose or oval, densely pruinose swellings having rudimentary leaves and near the tips of the smaller, tender shoots. These enlargements vary in length from 5 to 8 mm., they are spongy, the green interior containing a variable number of yellowish larvæ grouped along the central axis much as in the mature, more familiar

type of gall. The tissues at this time are soft and easily torn or cut. The identity of this type of gall with the more familiar form is established by finding on the twigs one gall, the apical portion of which was pruinose and with rudimentary needles, while the basal part had begun to turn brown and assume the characteristics of the mature gall, specimens of which also occurred upon the twigs. The newly developing galls contain small, pale yellowish larvæ scarcely $\frac{1}{2}$ mm. in length, while those on the older portions of the stem are inhabited by reddish orange, half grown larvæ. It would appear from the above as though the flight of the midges and deposition of eggs must extend over some weeks and development be comparatively rapid, otherwise such conditions could hardly obtain. The older galls will undoubtedly produce adults early in the spring, while from the smaller ones midges may not develop till into the summer.

Dicroidiplosis antennata, new species.

Larva.—Length 4 mm., a variable reddish orange, lighter and tapering somewhat at each extremity. Head small, slender, dark, chitinized, apparently greatly produced as a slender, decurved beak; breastbone long, slender, reddish brown and obtusely dentate, each segment ventrally with a transverse row of four light yellowish, rudimentary pseudopods; posterior extremity obtuse, tuberculate. Another larva is somewhat stouter, having a length of 3.5 mm., mostly yellowish and apparently with a shorter breastbone and a somewhat shorter, less distinctly chitinized head. This latter may possibly belong to another species.

Male.—Length 2 mm. Antennæ as long as the body, sparsely haired, the basal enlargement fuscous, the distal enlargement yellowish brown; 14 segments, the fifth having the stems with a length $1\frac{1}{4}$ and twice their diameters, respectively. Palpi: first segment short, irregular, second narrowly oval, with a length $2\frac{1}{2}$ times its diameter, the third $\frac{1}{2}$ longer than the second, moderately stout, the fourth apparently longer than the third, slender. Mesonotum dark brown. Scutellum fuscous yellowish, postscutellum yellowish, posteriorly yellowish brown. Abdomen reddish brown. Genitalia fuscous yellowish. Halteres yellowish apically, reddish brown basally. Coxæ yellowish. Legs mostly fuscous straw. Claws moderately stout, evenly curved, the pulvilli shorter than the claws. Genitalia: terminal clasp segment as long as the basal clasp segment, the latter strongly constricted basally and with a long, triangular lobe internally; dorsal plate deeply and narrowly emarginate, the lobes moderately slender, narrowly rounded and sparsely setose; ventral plate long, broad, roundly truncate.

Female.—Length 3 mm. Antennæ extending to the fourth abdominal segment, sparsely haired, pale yellowish; 14 segments, the fifth with a stem $\frac{1}{4}$ the length of the cylindric basal enlargement, which latter has a length thrice its diameter; terminal segment with a length four times its diameter and a short,

stout process apically, the latter a component of the segment. Palpi: first segment irregularly subquadrate, the second $\frac{1}{2}$ longer, the third a little longer than the second and the fourth $\frac{1}{2}$ longer than the third, slightly dilated. Mesonotum, scutellum and postscutellum dark brown. Abdomen mostly deep red, the dorsal sclerites somewhat fuscous, the short ovipositor pale yellowish. Halteres and coxae pale yellowish; femora, tibiae and tarsi mostly fuscous with three distal tarsal segments of the posterior legs yellowish white. Ovipositor about $\frac{1}{2}$ the length of the abdomen, the terminal lobes with a length over thrice the diameter and thickly setose. Type Cecid a2327.

The midge described above was reared by O. A. Johannsen, Orono, Maine, July 10, 1912, from reddish orange larvae preying upon the false maple scale, *Phenacoccus acericola* King. The male is quite different from any American representative of the genus, while the female closely approaches that of *D. gilletti*, it being distinguished therefrom by a difference in color and the longer, more slender terminal antennal segment having a short, stout appendage with no indication of partial segmentation, the latter condition existing in *D. gilletti*.

Dicropidopsis californica, new species.

Male.—Length 2 mm. Antennæ probably as long as the body, sparsely haired, yellowish brown; 14 segments, the 5th with stems $\frac{3}{4}$ and equal their diameters; the produced distal enlargement with a length about twice its diameter and a distinct constriction near the basal third. Palpi: first segment irregularly subquadrate, short, the second with a length only twice its diameter, the third a little longer, more slender, the fourth $\frac{1}{4}$ longer than the third and somewhat dilated. Mesonotum dark reddish brown, the submedian lines yellowish. Scutellum and postscutellum yellowish. Abdomen reddish brown, the basal segments yellowish; genitalia reddish. Wings hyaline, costa light brown, the third vein uniting with the margin just before the apex of the wing. Halteres yellowish transparent, reddish apically. Legs a fuscous straw; claws long, slender, strongly curved, the pulvilli as long as the claws. Genitalia: basal clasp segment long, stout; terminal clasp segment long; dorsal plate short, triangularly emarginate, the lobes broadly rounded; ventral plate moderately long, tapering, narrowly rounded.

Female.—Length 2 mm. Antennæ about $\frac{3}{4}$ the length of the body, sparsely haired, reddish brown; 14 segments, the fifth with a stem about $\frac{1}{4}$ the cylindric basal enlargement, which latter has a length nearly thrice its diameter; terminal segment only slightly produced, an obtusely rounded knob apically. Palpi: first segment short, subquadrate, the second with a length twice its diameter, broadly fusiform, the third about as long as the second, the fourth $\frac{1}{4}$ longer than the third, somewhat expanded. Mesonotum dark reddish brown, the submedian lines yellowish. Scutellum and postscutellum yellowish. Abdomen dark red,

the basal segments yellowish. Ovipositor about half the length of the abdomen, the terminal lobes with a length over twice the diameter, narrowly rounded. Other characters as in the male. Color characters from microscopic preparations. Type Cecid 1312.

The rather large, reddish brown species characterized below was reared in 1893 from a *Pseudococcus* species on *Solanum* at Riverside, California, and through the courtesy of Dr. Howard placed at our disposal for study. See the description of *D. helena* below for a statement of the differences between the two.

Dicroidiplosis helena, new species.

Gall.—Length 3 mm., subglobular, whitish, on the under surface of the leaf, opening on the upper surface.

Male.—Length 2.25 mm. Antennæ as long as the body, sparsely haired, fuscous yellowish; 14 segments, the fifth with stems $\frac{3}{4}$ and $1\frac{1}{2}$ their diameters; the distal enlargement narrowly oval, with a length $\frac{1}{2}$ greater than its diameter; terminal segment, the basal portion of the stem with a length twice its diameter, the distal enlargement produced, irregular, with a length thrice its diameter and tapering to a short, rounded apex. Palpi: first segment irregular, second with a length thrice its width, the third as long as the second, more slender, the fourth $\frac{1}{2}$ longer than the third, somewhat dilated. Mesonotum slaty brown, the yellowish submedian lines sparsely haired. Scutellum fuscous yellowish, postscutellum brownish red. Abdomen sparsely haired, dark brown, the incisures and pleura brownish red. Genitalia fuscous. Costa dark straw. Halteres mostly fuscous yellowish. Coxæ and base of femora light straw, the distal portion of femora, tibiæ and tarsi mostly fuscous. Claws slender, long, unidentate, the pulvilli as long as the claws. Genitalia: dorsal plate broad, broadly and triangularly emarginate, the lobes broadly triangular; ventral plate moderately broad, deeply and triangularly emarginate, the lobes narrowly triangular; style long, stout. Type Cecid a2210.

This species was reared April 5, 1912, from subglobular galls on the under side of aspen leaves, *Populus tremuloides*, collected by Miss Cora H. Clarke at Magnolia, Mass., the preceding August. It is easily separated from the allied *D. californica* by the shorter distal enlargement and the decidedly longer distal stem of the fifth antennal segment. It is also quite different from *D. populi* reared earlier from a similar gall. We are not certain that this is the maker of the gall.

Itonida aphidivora, new species.

Male.—Length 1 mm. Antennæ $\frac{1}{4}$ longer than the body, thickly haired, fuscous yellowish; 14 segments, the fifth having the stems each with a length $2\frac{1}{2}$ times their diameter; distal enlargement ovoid, with a length nearly twice

its diameter. Palpi: first segment irregular, with a length twice its diameter, the second a little longer, irregular, the third longer than the second, more slender, the fourth $\frac{1}{4}$ longer than the third. Mesonotum reddish brown, the submedian lines yellowish. Scutellum and postscutellum yellowish. Abdomen reddish orange, the genitalia fuscous yellowish. Wings hyaline, costa light straw. Halteres pale yellowish, slightly fuscous subapically. Coxæ and legs a nearly uniform fuscous yellowish. Claws slender, evenly curved, simple, the pulvilli $\frac{1}{3}$ the length of the claws. Genitalia: dorsal plate short, deeply and narrowly incised, the lobes narrowly rounded and sparsely setose apically; ventral plate long, expanded distally, broadly and roundly emarginate, the lobes plainly slender and tapering distally.

Female.—Length 1 mm. Antennæ extending to the fourth abdominal segment, sparsely haired, fuscous yellowish; 14 segments, the fifth with a stem $\frac{1}{3}$ the length of the slender basal enlargement, which latter has a length $2\frac{1}{4}$ times its diameter; terminal segment produced, with a length four times its diameter and apically a stout, fusiform process nearly as long as the basal portion. Palpi: first segment irregular, the second broadly oval, with a length $\frac{1}{2}$ greater than its diameter, the third a little longer, slender, the fourth fully $\frac{1}{2}$ longer than the third, more slender. Face yellowish. Mesonotum dark brown, the submedian lines yellowish. Scutellum and postscutellum yellowish. Abdomen yellowish orange. Ovipositor short, the terminal lobes narrowly oval, with a length over twice the diameter and sparsely setose. Type Cecid a2316a.

The small midge described above was reared in some numbers July 11, 1912, from apple leaves infested by the rosy aphid, *Aphis malifoliae* Fitch collected at Nassau, N. Y. This species was more numerous than an associated larger form, probably an *Aphidoletes*. It may be separated from the allied *I. sanguinia* Felt by the yellowish orange abdomen, the stems of the 5th antennal segment being equal and the fourth palpal segment a little longer than the third.

Itonida putrida, new species.

Male.—Length 1.5 mm. Antennæ $\frac{1}{4}$ longer than the body, thickly haired, yellowish brown, yellowish basally; 14 segments, the fifth having the stems as long and $\frac{1}{2}$ longer than their diameters, respectively; distal enlargement with a length $\frac{1}{4}$ greater than its diameter; terminal segment produced, the distal enlargement broadly fusiform, with a length twice its diameter and a short, stout knob apically. Palpi: first segment subquadrate, the second a little longer, stouter, the third a little longer than the second, more slender, the fourth $\frac{1}{2}$ longer than the third, dilated. Mesonotum slaty brown, the fuscous yellowish submedian lines sparsely haired. Scutellum fuscous yellowish, postscutellum reddish brown. Abdomen yellowish orange, the terminal segments dark carmine. Genitalia fuscous yellowish. Wings hyaline, costa light straw. Halteres yellowish basally, reddish apically. Coxæ and femora mostly fuscous yellowish; tibiae somewhat darker, tarsi dark straw; claws evenly curved, the pul-

villi a little shorter than the claws. Genitalia: dorsal plate broad, deeply and triangularly emarginate; ventral plate broad, broadly and roundly emarginate. Type Cecid a2264a.

This male was reared April 15, 1912, from a jar containing numerous larvæ of *Bolitophila cinerea* Meign. found in the trunk of a decaying birch. It is allied to *I. setariae* Felt, being separated therefrom by the short basal portion of the stem of the fifth antennal segment.

***Itonida aprilis*, new species.**

Male.—Length 2 mm. Antennæ $\frac{1}{2}$ longer than the body, rather thickly haired, fuscous yellowish; 14 segments, the fifth having the stems each with a length about $2\frac{1}{2}$ times its diameter; distal enlargement subcylindric, with a length nearly twice its diameter and slightly constricted near the basal third; terminal segment, distal enlargement somewhat produced, with a length thrice its diameter and obtuse apically. Palpi: first segment with a length over thrice its diameter, second a little longer, broader, the third longer and more slender than the second, the fourth $\frac{1}{2}$ longer than the third, nearly uniformly dilated. Mesonotum dark brown, the fuscous yellowish submedian lines sparsely haired. Scutellum dark reddish brown, postscutellum dark brown. Abdomen sparsely haired, dark yellowish brown. Wings hyaline, costa dark straw. Halteres fuscous yellowish; coxæ and legs fuscous yellowish, the tarsi somewhat darker; claws stout, strongly curved, the pulvilli about $\frac{1}{3}$ the length of the claws. Genitalia: dorsal plate short, deeply and triangularly emarginate; ventral plate long, broad, triangularly emarginate, the lobes short. Type C. 1414.

The males described above were captured in some numbers April 13, 1912, at Albany, N. Y. This appears to be one of the earlier spring forms and is related to *I. sanguinia* Felt. Nothing is known concerning its life history.

***Itonida resinicola* O. S.**

Larva.—Length 6 mm., stout, tapering at both extremities, a mottled, yellowish orange. Head skeleton, fuscous, chitinized; breastbone small, indistinct, posterior spiracles borne by submedian processes, heavily chitinized apically.

Twigs of pitch pine were collected June 5, 1912, bearing the characteristic pitch masses of this midge inhabited by numerous reddish orange larvæ, some of which have the posterior spiracles protruding above the surface of the pitch. Many, however, are well within the pitch mass and apparently remain in this condition for extended periods.

The habits of this species appear to vary markedly from those of *I. inopis* O. S., since midges of this latter species were reared

the latter part of May, practically none appearing later and there being no conspicuous exudations of pitch. The larvæ of *I. resinicola* have probably wintered in these pitch masses, resuming activity in the spring and producing at the present time large, fresh looking, white masses of pitch.

On the 17th larvæ collected June 12th had all withdrawn from the surface and were observed lying in the interior of the pitch mass against the wood and apparently in an oval cocoon. They remained in this condition until the 24th, at which time the pupæ had wriggled to the surface and disclosed imagoes, the exuviae protruding part way from the pitch mass. The head and thoracic portions of the exuvium are slightly and variably fuscous, quite different from the nearly uniform, densely pigmented exuvium of *I. inopis* O. S. There is no evidence of *I. resinicola* deserting the pitch mass and making resinous cocoons on the leaves, as is the case with *I. inopis* (see account of the latter in Journal Economic Entomology, 1912, 5: 368-69).

Cecidomyia ocellaris O. S.

Some exceptionally vigorous larvæ and one or two puparia of this species were received June 18, 1912, from Miss Cora H. Clarke, Magnolia, Mass.

The breeding jar containing this material has been under constant observation, and on July 17, 1912, an examination of three puparia showed that each contained a stout, white, apparently healthy larva. There seems to be no indication of an impending transformation. The puparia are oval, stout, brown, more or less irregularly reticulated and slightly ridged. The irregular ridged and reticulated appearance appears to be due largely to the arrangement of somewhat stouter, dark brown threads, which latter appear to perform no special function. One or two of these puparia were attached at almost right angles to the leaf surface, while a group of four or five lay side by side in a leaf fold. We have obtained puparia repeatedly without securing the midge and take this opportunity of expressing the hope that some entomologist will shortly be more fortunate and rear adults.

A REVIEW OF THE NORTH AMERICAN SPECIES OF COLLOPS (COL.).

BY H. C. FALL,

PASADENA, CAL.

For upward of forty years the table of species of *Collops* and brief accompanying notes, published by Dr. Horn in 1870, has been the sole means by which American students and collectors have identified their material, and as such has done good service. There are however one or two positive errors in the table, and this fact together with the desirability of incorporating the considerable number of new species herein or recently described has led to the preparation of a new table. While the material upon which the present paper is based has not been sufficient for an exhaustive review, it is believed that the table together with the following descriptive and comparative notes—brief or detailed as seems necessary in each case—will enable the student to identify nearly everything now in collections with tolerable accuracy. Positive identification with females alone is often impossible, and in the material examined I have left a number of such unplaced, one or more of which may prove to be new when males are found.

Notwithstanding its instability there can be no doubt that color offers the simplest and most useful means of dividing the genus into primary groups. The tendency to variation in color appears to be very slight in some species while in others of quite similar type it is strongly in evidence; in all cases however it manifests itself in certain definite directions. In species with elytra normally maculate the spots may vary in size and often have a tendency to coalesce and form vittæ. In the normally vittate species the variation is in the reverse direction, the vittæ becoming more or less narrowed at the anterior third or even entirely divided. The thoracic spot is prone to vary much in size and may be present or entirely absent in the same species. The extreme of variation in this respect is shown in *versatilis*, in which the thorax may be entirely red, entirely black or with intermediate forms. The color of the legs is fairly constant in a few species but is subject to more or less variation in the greater number,

and in these it is the four anterior legs that are most affected. In general the variation consists in the extension of one of the colors in those having some or all of the legs bicolored, but never in my observation extends to a reversal of colors. For instance—it may be assumed with tolerable certainty that a specimen having black femora and red tibiae is not specifically identical with one having red femora and black tibiae, though it might not be distinct from one having the legs entirely red or entirely black. The color of the abdomen is of decided value if used with caution. The size of the lateral black spots varies considerably, but a species with abdomen normally immaculate, while it may sometimes show faint traces of lateral spots will rarely if ever have them heavily marked. In the following table care has been taken to recognize the more important color variations either in the table itself, or by tabulating the species in more than one position—or by indicating before each group those species which in certain color phases would fall in a position other than that which they occupy.

Variations in sculpture within specific limits are inconsiderable and will be referred to under those species in which it has been observed. It may be here remarked however that in most species the sides of the prothorax show a tendency to become more or less narrowly substrigose or regulose and opaque along the margin, which area may become much wider in some individuals or even in rare instances involve the whole surface. Structural characters useful in delimiting species are, aside from those offered by the male antennæ, almost wanting. The antennæ of the male, more especially the first two joints, show much diversity in form and offer specific characters of the highest importance. The very large joint with claw-like appendage, although really the third, will in the following pages be referred to as the second, which to all appearances it seems to be.

My grateful acknowledgments are due to Prof. H. F. Wickham, Mr. Chas. Liebeck, Mr. W. Kraus, Mr. Chas. Schaeffer, Mr. L. E. Ricksecker, Dr. F. E. Blaisdell, Dr. A. Fenyes, Mr. C. A. Frost, Mr. A. B. Wolcott and Dr. Henry Skinner for assistance offered in the way of specimens kindly sent for examination during the progress of the work. According to the prevailing color scheme our species may be arranged in three groups, as follows.

Elytra dark blue, green or blackish, unicolorous except occasionally for a narrow pale edge at the middle of the lateral or sutural margin of the elytra.

Group A.

Elytra each with a broad longitudinal dark blue or greenish vitta usually more or less narrowed at basal third, the sutural, apical and lateral margins as a rule more or less completely pale.....*Group B.*

Elytra rufous, each with a dark blue or green basal and subapical spot of variable size, sometimes longitudinally confluent.....*Group C.*

Group A.

With the exception of *sublimbatus* the species tabulated below have the elytra completely unicolorous or virtually so. *Sublimbatus* is included because of its relation to *tricolor*, of which indeed it may be no more than a variety. In *tricolor* the middle of the external lateral edge of the elytra is often rufous or rufescent, and in *sublimbatus* this is more marked and affects also the sutural margin for a greater or less distance. *Necopinus* is included here to cover certain forms with nearly unicolored elytra but with the middle of the sutural and lateral margins faintly rufous; the species however belongs more properly to the next group.

Humeri small, elytra expanded posteriorly, wings rudimentary; elytra coarsely densely punctate, shining.....*cribosus*.

Humeri larger, wings well developed, elytra much less coarsely punctate (except *punctatus* and *nigritus*).
Prothorax reddish yellow, immaculate or with at most a small central spot in some examples of *punctatus* and *partitus*.

Prothorax small, not or but little more than half as wide as the elytra, which are narrow at the humeri and strongly expanded posteriorly: femora black, tibiae and tarsi rufous.....*partitus*.

Prothorax larger, distinctly more than half as wide as the elytra.

Basal joint of antennæ (δ) without dentiform prominence, though evidently angulate in *punctatus* and *nigritus*.

Legs black.

Elytra rather strongly widened posteriorly, punctuation fine, abdomen entirely or in part red.

Basal antennal joint (δ) elongate triangular, $\frac{1}{2}$ or $\frac{2}{3}$ longer than wide.....*vicarius*.

Basal antennal joint of σ broadly triangular, nearly or quite as wide as long.

Elytral suture not or but feebly rufous at middle.....*tricolor*.

Elytral suture and side margin in part rufous.
sublimbatus.

- Elytra subparallel, widest near the middle and distinctly more deeply and coarsely punctate, abdomen black.
 Second antennal joint (δ) very little if any wider than long *punctatus*.
 Second antennal joint (δ) rather strongly transverse— $\frac{1}{3}$ wider than long—elytral punctuation even coarser *nigritus*.
 Femora and tarsi pale rufous, tibiae dusky or blackish.
 marginicollis var. *claricollis*.
 Basal antennal joint of δ with anterior dentiform prominence; femora red, tibiae and tarsi blackish, size very large *dux*.
 Prothorax rufous with a discal black spot of variable extent, sometimes almost entirely black (spot wanting in *nigriceps* var. *floridanus*).
 Third antennal joint of δ similar to following joints.
 Elytra blue or green.
 Elytra densely punctate and minutely tuberculate, opaque; basal joint of antennæ (δ) triangular, appendix of second joint short.
 Antennæ of δ moderately serrate, front and middle legs largely rufous in typical form *marginicollis*.
 Antennæ of δ strongly serrate, legs black *reflexus*.
 Elytra shining, not evidently tuberculate.
 Basal joint of antennæ (δ) subquadrate when viewed from the front and above, appendage of second joint long.
 Antennæ of δ feebly serrate.
 Prothorax and legs black *hirtellus*.
 Prothorax margined with yellow, legs largely yellow var. *lucens*.
 Antennæ of δ strongly serrate *discretus*.
 Basal joint of antennæ (δ) subtriangular, a little longer than wide, middle of sutural and lateral marginal beads of elytra rufescent, appendix of second joint short.
 necopinus var.
 Basal joint of antennæ (δ) elongate triangular, elytral margins not rufescent at middle, appendix of second joint short *subtropicus*.
 Elytra black with aeneous luster *subaeneus*.
 Third antennal joint of δ dilated, subquadrate and much wider than the following joints when viewed from behind and above *nigriceps*.
 Prothorax entirely rufous var. *floridanus*.
 Prothorax rufous with two small black discal spots; size large... *bipunctatus*.

Group B.

Because of its close relation to *tricolor*, *sublimbatus* has been tabulated in the preceding section, but the more or less pale elytral margins would point to a position in the present group. If placed here it would fall with *confluens*, which differs by its entirely pale margins, coarser punctuation and elongate basal antennal joint of the ♂.

Marginellus occasionally occurs with head, under surface and legs entirely pale, in which case it may be distinguished from *georgianus* by the polished thorax and entirely pale margins of the elytra.

Vittatus and *marginellus* occasionally have the thorax immaculate; they are then separable from *laticollis* and *granellus* by the absence of elytral tubercles, and from *confluens* by the broadly triangular basal antennal joint in the ♂, and less coarsely punctate elytra.

Tibialis of the next group having the elytral spots confluent will also fall with *laticollis*, etc., but may be separated by the trilobed yellow margin of the front and nontuberculate elytra.

Both *histrio* and *versatilis* of group C occur also with the elytral spots confluent, but the sinuate basal antennal joint in the ♂ will distinguish them from any species of the present group.

Prothorax polished and strongly shining, at least medially (except in *georgianus*).

Antennæ of ♂ very strongly acutely serrate, elytral vittæ broad and scarcely narrowed at anterior third; head pale in front of a line tangent to the anterior margins of the eyes; legs, except hind femora, pale....*limbellus*.
Antennæ of ♂ moderately serrate.

Head in great part rufous, the sides only blackish, entire under surface and legs pale.....*georgianus*.

Head mostly black, under side and legs more or less black (except in some specimens of *marginellus*).
Erect hairs entirely whitish, pale margins of elytra of nearly uniform width*flavicinctus*.

Erect hairs of body black.

Prothorax entirely rufous.

Elytra with minute tuberculiform elevations, size moderately large.

Pale sutural and lateral margins of the elytra continuous around the apex.....*laticollis*.

Pale margins of the elytra not continuous around the apex*granellus*.

Elytra without trace of tuberculiform elevations.

confluens.

Prothorax with large discal black spot, which is sometimes divided or even entirely lacking in *vittatus* and *marginellus*.

Pale lateral and sutural margins of elytra very narrow and never entire, second joint of antennæ (δ) obviously transverse *necopinus*.

Pale margins of elytra entire.

Basal joint of antennæ (δ) short, thick, broadly subovate triangular, as wide as long or virtually so when viewed from the front; second joint not or but very slightly wider than long *marginellus*.

Basal joint of antennæ (δ) much less stout and distinctly longer than wide, second joint usually as long as wide *vittatus*.

Prothorax finely alutaceous and dull throughout, the punctures fine, sparse and evenly distributed over the entire disk; form depressed, size small (3-3½ mm.) *punctulatus*.

Group C.

Prothorax rufous with two elongate discal black spots, size large—6½-7½ mm.
validus.

Prothorax rufous, immaculate.

Wings rudimentary or wanting, elytra narrow at base, head in great part red, basal spots of elytra elongate..... *crusoe*.

Wings developed, elytra wider at base and with the basal spots not elongate.

Basal joint of antennæ in the δ sinuately excavate or impressed on its posterior face.

Abdomen and legs red, the tibiæ usually dusky..... *pulchellus*.

Abdomen heavily maculate with black, rarely entirely red, legs black *histrio*.

Basal joint of antennæ in the δ not sinuate posteriorly.

Head rufous with a small central bluish spot, legs and abdomen entirely pale *scutellatus*.

Head black, frontal margin yellow as far as the eyes, its posterior border not lobed *similis*.

Head black, front with a posteriorly trilobed yellow margin, the lateral lobes attaining the eyes *tibialis*.

Head black, front without or with very narrow yellow border, its posterior edge straight.

Basal joint of antennæ in the δ slender, fully twice as long as wide, elytra coarsely densely punctate..... *confluens*.

Basal joint of antennæ in the δ thicker and shorter, barely $\frac{1}{2}$ longer than wide, elytra less coarsely punctate.

Legs bicolored, abdomen red in the ♂, maculate in the ♀,
elytra more densely punctured, dull or feebly shining.
femoratus.

Legs black, abdomen heavily maculate with black in both
sexes, elytra less densely punctured and moderately
shining *4-maculatus.*

Prothorax with discal black spot (lacking in *texanus*).

Elytra densely rather coarsely punctate, prothorax polished, elytral spots
very large, separated by a rather narrow transverse subparallel fascia;
size large *balteatus.*

Elytra finely not very closely punctate, prothorax glutaceous and dull
throughout, size small.

Sides of the prothorax rather broadly pale... *punctulatus* var. *insulatus*.

Prothorax entirely black..... *punctulatus* var. *utahensis*.

Prothorax entirely pale..... *punctulatus* var. *texanus*.

Prothorax black, varying to maculate or entirely rufous, elytra each with a basal
and subapical spot (typical), these uniting in some specimens to form a lon-
gitudinal vitta narrowed at about the middle. Basal joint of antennæ in the
♂ sinuate posteriorly, second joint strongly transverse; elytral punctuation
fine and not very close, legs black in large part, the tarsi and sometimes the
front and middle tibiæ pale..... *versatilis.*

C. cribrosus Lec. Proc. Acad. Nat. Sci. Phila., 1852, p. 164.

Head black, the labrum, epistoma and the anterior portion of the front pale.
Antennæ pale throughout in the ♂, the outer joints more or less infuscate in
some ♀♀; basal joint distinctly impressed or sinuate on its posterior face, sub-
rectangular and about one half longer than wide as viewed from the front.
Prothorax black with very narrow pale lateral edge in the typical form, varying
through rufous with a central black spot (rarely divided) to entirely red; sur-
face polished and finely sparsely punctate. Elytra dark blue or green, shining,
closely and coarsely punctate. Front legs pale, middle ones variable, hind ones
black. Length 3-4 mm.

This is one of the most easily recognized of all our species because
of the oval elytra, narrow at base and without humeri. In all the
specimens that I have seen the wings appear to be completely want-
ing, in which respect it may be distinguished from all our other
species except *crusoei*. The statement by Dr. Horn that some speci-
mens have well developed wings and that the transition is gradual
through others with imperfectly developed wings to those with none
at all, I have for some time looked upon with suspicion. Horn
expressly states that the better developed specimens are from the salt
marshes of the Owens Valley, and to settle the question, Dr. Skinner
has at my request kindly sent me for examination the greater part of

the Horn series of *cribosus*. As I had suspected, the Owens Valley specimens prove to belong to an entirely distinct species—the *uccopinus* n. sp. of the present paper. The true *cribosus* appears to be strictly confined to the coast line of the Pacific, ranging from British Columbia to San Diego, Cal., and very likely into the Peninsula.

C. parvus Schaeff. Can. Ent., June, 1912, p. 185.

Head black, finely punctate, labrum and epipharynx yellow. Prothorax small, rufous, immaculate—rarely with black spot—smooth, $\frac{1}{4}$ or $\frac{1}{5}$ wider than long, sides very broadly arcuate. Elytra green or blue, dilated posteriorly, punctuation dense, about as in *tricolor*. Antennæ (δ) piceous, the basal joint yellow with a black spot; (φ) basal joint pale, 2-4 bicolored, following joints piceous. Abdomen rufous with lateral black spots. Femora black, tibiae and tarsi pale. Length 3- $3\frac{3}{4}$ mm.

Douglass, Arizona (Snow); Thornton, N. Mex. (Fenyes); S.W. Texas (Horn Coll.). Schaeffer describes simply from Arizona.

This species resembles *tricolor* in color but is smaller, and narrower anteriorly, the prothorax but little more than half as wide as the elytra. The color of the legs is quite constant in the four examples before me and quite different from *tricolor*. The basal joint of the antennæ in the δ is strongly angulate in front and obviously sinuate posteriorly (not so in *tricolor*), the large joint piceous on its convex face.

There are specimens of this species in the LeConte collection bearing the MS. name *femoratus*, which was evidently unpublished. Gorham uses this name for a Guatemalan species and the description fits the present insect very well, but the length, which is said to be $5\frac{1}{2}$ -6 mm., is so great as to make the identity of the two altogether improbable. I am much inclined to believe that the species referred to as *punctatus* on p. 316 in the supplement to Vol. III of the *Biologia* is the one here described and not the true *punctatus*.

C. tricolor Say (Malachius). Jour. Acad. Nat. Sci. Phila., III, 1823, p. 183.

"Head black; labrum, clypeus on its anterior margin and palpi at base rufous; antennæ pale rufous, dusky at tip; thorax transverse, nearly oval, rather short, rufous, immaculate; elytra dark bluish green or somewhat violaceous, middle of the lateral edge obsoletely piceous; postpectus and feet deep black; venter testaceous."

The above is the original description of Say, to which I may add, that in the specimens at hand the prothorax is polished and subim-

punctate except very sparsely toward the sides; the elytra feebly to moderately shining in the ♂, usually more or less dull in the ♀, rather finely punctate, the lateral edge rufous or rufescent at middle in some specimens, scarcely so in others; venter with more or less evident lateral black spots in the ♂, entirely rufous in the ♀, rarely with faint traces of spots. Basal joint of antennae in the ♂ broadly triangular, as wide as long or very nearly so, not sinuate posteriorly.

In one of two examples collected at Plummer's Island, Md., by Dr. Blaisdell, the sutural bead is rufescent for a short distance at middle, and in the other one is entirely red, the side margin being in both narrowly red at middle as is often the case. A ♀ from Nebraska is similarly colored, but in the absence of the ♂ its identity is open to doubt. These specimens almost perfectly bridge the gap between typical *tricolor* and *sublimbatus* Schaeff. and indicate strongly that the latter may be only a color phase of the former.

Say says that this species was taken on the Mississippi and that specimens also occurred near the Rocky Mts., and a slight color variety in Massachusetts. The species does not seem to be at all common in the Mississippi Valley, and a special application to Messrs. Wickham, Knaus, Wolcott and Liebeck brought me only eight specimens. Of these three are ♂'s and by antennal differences evidently include two quite distinct species, one represented by a St. Louis specimen (Liebeck), the other by examples from Indiana (Wolcott) and Indian Territory (Wickham). The two species are exceedingly similar and scarcely separable except by antennal characters. The females can only be placed when associated with males. It is obviously quite impossible to determine which of these species is the true *tricolor* of Say, and since the St. Louis specimens are apparently identical with the common form of the Atlantic coast region which has always passed as *tricolor*, Say's name may best be retained for this species.

Tricolor is rather common, locally at least, from Quebec to Virginia, occurring as a rule at no great distance from the coast. Its range in the Mississippi Valley can not now be determined. Females of this type have been seen from Kansas, Nebraska and Lake Superior (LeConte Coll.), but being unaccompanied by males their identity is doubtful. The Indiana and Indian Territory ♂♂ will be described below as *vicarius* n. sp.

C. sublimbatus Schaeff. Can. Ent., June, 1912, p. 187.

As indicated under *tricolor* the characters of this form are precisely those of that species except that the sutural and lateral marginal beads are in great part rufous. It should probably be placed as a variety of *tricolor*. It is represented before me by a ♂ cotype from Clayton, Ga., kindly submitted for examination by Mr. Schaeffer.

C. vicarius, new species.

Extremely like *tricolor* and separable with certainty only by the ♂ antennal characters. The basal joint of the ♂ antenna is here much less broadly triangular than in *tricolor*, being more than $\frac{1}{2}$ longer than wide, and the 2d joint is less transverse and when viewed on the convex side the exterior apical angle is less produced and more broadly rounded than in *tricolor*.

Type from Miller, Indiana, collected by Mr. A. B. Wolcott; a second ♂ from McAlester, Indian Territory, collected by Professor Wickham.

In the type the elytra are deep blue, in the Indian Territory specimen distinctly greenish; in both they are quite shining and feebly or scarcely alutaceous and without trace of rufescent space on suture or side margin, the epipleura even being completely concolorous. The venter is more distinctly maculate at sides in the ♂ than is usually the case in *tricolor*. These characters may or may not be significant, and much more material is necessary to determine their value.

C. punctatus Lec. Proc. Acad. Nat. Sci. Phila., 1852, p. 164.

A rather small, narrow and convex species. Elytra blackish in the type, faintly bluish or dull green in some examples. Head black, unusually densely and coarsely punctate. Antennæ feebly serrate, black, basal joint pale with black spot, second joint pale or with the convex surface more or less blackish. Prothorax rufous, immaculate or with a discal spot of variable size. Elytral punctures very coarse, varying in density. Legs almost entirely black, ventral segments black with pale apices. The basal joint of the antennæ in the ♂ is rather strongly bent, the anterior margin distinctly angulate as viewed from above.

This species is known to me from "Kansas"; Benedict, Kansas; Malcolm, Nebraska; Colorado Springs and Fort Collins, Colorado; "New Mexico"; Pecos, New Mexico.

The type bears a green disk locality label and in the original description is said to be from "Missouri Territory" (probably Western Kansas or Nebraska); the second example is from Kansas. Two other examples from Garland, Colorado, and one from New Mexico

are wrongly placed with *eximus*, and herein, doubtless, lies the source of the erroneous recording of *eximus* from these Rocky Mt. States.

In the type the elytral punctuation is not very close, but is evidently denser in the second example, while in the New Mexico specimen it is very dense and rugose. The legs in the type are entirely black except the front and middle trochanters; in the second example the front thighs are largely pale, as are all the trochanters.

C. nigritus Schaeff. Can. Ent., June, 1912, p. 185.

A ♂ in my collection from the Santa Rita Mts., Arizona (Snow), agrees perfectly with Schaeffer's unique type from Arizona, which I have seen. The prothorax is more densely punctured than in any specimen of *punctatus* that I have seen and the second antennal joint is more transverse. The two species are very close but may be regarded as distinct if the antennal character holds good.

C. dux, new species.

Male.—Head, antennæ except the basal and part of the second joint, metasternum, tibiæ and tarsi, black; labrum and epistoma, base of antennæ and femora, reddish yellow; elytra blue. Head finely and quite closely punctate, minutely and less closely so anteriorly. Basal joint very thick and of irregular form, wider than long from any view point, a subdentiform prominence in front when seen from above; second joint very irregular, the convex face black except at base, and strongly emarginate and narrow in apical half when viewed from beneath, claw-like appendage long; third joint transverse, its apex squarely truncate, following joints moderately serrate, decreasing in width, the outer ones elongate. Prothorax transversely oval, $\frac{3}{5}$ wider than long, surface polished and very finely remotely punctulate. Elytra somewhat depressed, about $\frac{1}{2}$ longer than wide, sides straight and a little divergent posteriorly, surface very densely finely punctate and dull, vestiture of fine recurved whitish hairs and erect black hairs, the latter shorter than usual. Length $7\frac{1}{2}$ mm. (head depressed); width 4 mm.

Del Rio, Texas. A single ♂ sent by Mr. Wickham, who retains the type.

This very large and fine species is remarkably distinct, the form of the basal two joints of the antennæ being quite unlike those in any other of our species.

C. marginicollis Lec. Proc. Acad. Nat. Sci. Phila., 1852, p. 164.

Male.—Labrum, clypeus, antennæ, venter, front and middle femora and hind femora in part, rufous; head behind the clypeus black with greenish luster. Prothorax rufous with large black spot, often leaving only a narrow pale margin; elytra blue or violaceous; meso- and metasternum black; tibiæ and tarsi black. Basal joint of antennæ triangular, about $\frac{1}{2}$ longer than wide,

not distinctly flattened in front; second joint strongly transverse, the claw-like appendage moderate in length; following joints rather strongly serrate, all transverse except the tenth. Head minutely numerously punctulate, moderately shining. Prothorax transversely oval, $\frac{1}{2}$ wider than long, entire surface polished and very finely remotely punctate. Elytra about $\frac{1}{3}$ wider than the prothorax at their point of greatest width, evidently but not very strongly widened behind, surface finely densely punctate and minutely tuberculate, luster dull or but slightly shining. Vestiture as usual.

Female.—Second antennal joint a little longer than wide, as long as the next two, and in width equal to the fourth; color as in the ♂ except that the hind femora, and the antennæ except at base, are blackish. Length 4-5 mm. (head deflexed).

The type is from San Diego, Cal., and all the typical specimens before me are from that vicinity. Two examples from Nephi, Utah (Coll. Wickham), differ only in having all the legs black; there are also Utah specimens placed with *marginicollis* in the Horn collection. Two ♀♀ from southern Arizona submitted by Mr. Schaeffer, and one from the same region in my own collection also have entirely black legs but are otherwise scarcely separable. These agree well enough with the short description of *aulicus* Er., a Mexican species and may be that, but in the absence of ♂♂ and of authentic examples of *aulicus* nothing more definite can be said.

The following varietal form is sufficiently constant and of different appearance to merit a name.

Var. *claricollis*, new var.

Prothorax bright rufous, immaculate, femora entirely rufous and tarsi usually so, tibiae dusky or blackish. Southern California (Pomona, Pasadena, Azusa).

C. *reflexus* Lec. Ann. Report, Chief Engineers, 1876, p. 517.

This is very similar to *marginicollis* in size, form and sculpture, and differs chiefly in the more strongly serrate male antennæ. The form of the first and second joint is virtually the same in both. The prothorax is entirely black, the margin about the basal angles being narrowly more or less brownish, and the legs are all black. The little tuberculiform elevations of the elytra are quite noticeable as they are in *marginicollis*, and by their presence these two species are readily separable from all others with unicolored elytra except *nigriceps* and *bipunctatus*, both of which are easily recognized by other characters. The tuberculiform elevations are feebly developed in *nigriceps* and often scarcely detectable.

C. hirtellus Lec. Ann. Report, Chief Engineers, 1876, p. 517.

Of medium size, dull to moderately shining. Head black, shining, finely not densely punctate with widely scattered coarser setigerous punctures; labrum and epistomal margin pale. Antennæ (δ) feebly serrate, black, the lower half of the basal joint and the excavate face of the second joint, pale. Basal joint as viewed from the front triangular, excavate posteriorly, very distinctly wider at apex than long. In the ♀ the basal joint is pale with a median dusky spot, the 2d and 3d joints pale in part. Prothorax entirely black, polished and subimpunctate medially, duller and subrugose laterally. Elytra closely punctate, not tuberculate, dark blue, rarely greenish. Venter with sides more or less heavily maculate with black. Legs almost entirely black in type, the front and more rarely the middle femora becoming in part pale in some specimens.

The type series is from Taos Peak—13,000 ft.—northern New Mexico. I have also seen specimens from Elko, Nevada (Wickham); Moscow, Idaho; Pullman, Washington (Mann); and Radisson, Saskatchewan (Willing).

Var. lucens, new var.

A form taken at Coolidge, New Mexico, by Professor Wickham and sent out by him as *hirtellus* differs from the type series in being more shining, the prothorax with narrow pale lateral and basal margins, pale epistomal margin lobed at middle, front and middle legs pale, the hind legs largely dark in one example and with the femur and base of tibia dark in the other; basal joint of antennæ entirely pale and not wider than long. A specimen from Salt Lake, Utah (Horn Coll.), collected by Schwarz (?), has the basal antennal joint (δ) black superiorly and the thoracic pale margin present around the sides only, thus approaching *hirtellus*.

C. discretus, new species.

Head greenish black, labrum and anterior part of the front pale, the pale margin trilobed posteriorly, the lateral lobes reaching the eyes, the middle lobe broader and a little more produced; punctuation sparse and very fine, the setigerous punctures scarcely coarser. Antennæ (δ) strongly serrate, entirely yellow except for the apices of the outer joints; basal joint not excavate posteriorly, oblong as viewed obliquely from the front and above, broadly triangular and about as wide as long when viewed from the front and below; second joint subpentagonal, strongly transverse, appendage moderately long. Prothorax entirely black, polished throughout, punctures very fine and remote, a little closer and subsperate near the side margins. Elytra dark blue, strongly shining, rather finely and not very closely punctate. Body beneath black, the ventral sutures narrowly pale. Legs black, the front tibiae and tarsi pale. Length $4\frac{1}{2}$ mm.

Colorado (Troublesome); a single ♂ in my own collection.

C. subtropicus, new species.

Head black, labrum and epistoma pale, antennæ pale at base, becoming infuscate apically. Prothorax rufous with broad median black stripe; elytra deep blue; venter rufous, sides heavily maculate with black. Basal joint of antennæ (δ) subtriangular, not quite twice as long as wide, not excavate posteriorly. Second joint a little wider than long, appendix short; third joints as wide as those following. Prothorax polished, finely sparsely punctate. Elytra quite strongly shining, rather densely but not very coarsely punctate, pubescence as usual. Length $3\frac{1}{2}$ mm.

Jacksonville and Tampa, Florida, 2 δ 's; the former the type in my own collection, the latter in the Horn collection.

Mr. Schwarz writes me that there are similar specimens from tropical Florida in the National Museum Collection.

The specimens before me are a little smaller and even more shining, the punctuation of the elytra slightly coarser, and the basal antennal joint a little more elongate than in *vicarius*, but otherwise they are very close to the latter. The prothoracic stripe may or may not be constant in *subtropicus*; it is probably never present in *vicarius*.

C. subæneus, new species.

Black, elytra faintly æneous, labrum, basal joint of antennæ and the upper edge of the three following joints pale; prothorax rufous with broad black median stripe; abdomen rufous, sides heavily maculate with black; legs black. Head finely, rather sparsely punctate with a few coarser setigerous punctures; thorax finely remotely punctulate; elytra closely not coarsely punctate. Antennæ (φ) rather strongly serrate. Length 4 mm. (head deflexed).

California. Contra Costa Co. and vicinity of Sacramento. Described from three φ 's submitted by Dr. F. E. Blaisdell.

The description of a species of *Collops* from the females only is rarely justifiable but the total dissimilarity in color of the present species makes it highly improbable that this can be a variety of any previously described form occurring in the same region; it is in any event worthy of a varietal name.

C. nigriceps Say. Jour. Acad. Nat. Sci. Phila., 1823, III, p. 183.

C. eximus Er. Entomographien, p. 57.

Var. *floridanus* Schaeff. Can. Ent., 1912, p. 185.

A common species along the Atlantic Coast line from Massachusetts to Florida; it occurs also on the Gulf Coast at least as far as Mobile, Ala. The thoracic spot seems to be large and constantly present in the northern specimens but is sometimes entirely absent

in examples from Florida. These constitute the variety *floridanus* of Schaeffer; they are however connected with the type form by intermediates. It seems to have escaped notice hitherto that the form of the 3d antennal joint in the ♂ separates this species at once and decisively from all others. The female antennæ are of normal form and examples of this sex of *floridanus* may be confused with *tricolor*.

The identification by LeConte of certain specimens of *punctatus* taken in New Mexico by Snow and in Colorado by Hubbard and Schwarz, as *eximius*, was hasty and unfortunate, the error persisting in faunal lists down to the present time. My own observations lead me to the conclusion that there is no possible way of separating *eximius* Er. from *nigriceps* Say. Erichson remarks under his description of *eximius* that it is very close to *nigriceps*, differing in its shorter form, color of the abdomen and legs, and shorter hair. He describes the abdomen as rufous with the last segment fuscous, while of *nigriceps* he says: "abdomen testaceous with two series of black spots." Horn says of *eximius* in his review "abdomen and front legs rufous" and of *nigriceps* "abdomen and legs black." In this statement he is evidently influenced by Erichson; it is however quite unwarranted, for Say says in his description of *nigriceps*—"venter sanguineous, feet black, thighs sometimes rufous, particularly the anterior ones," which is almost precisely what Erichson writes of *eximius*. As a matter of fact the color of the abdomen varies from almost entirely rufous to heavily maculate with black, through all intermediate forms, while the legs may be entirely black, or with the thighs in part rufous as stated by Say. These variations are intercurrent and are not confined to any geographical region. The peculiar form of the male antennæ is the same in all.

C. bipunctatus Say. Jour. Acad. Nat. Sci. Phila., III, 1823, p. 185.

This is a fine large species and so well known as to need little comment. It is at once recognized by its size, combined with the entirely blue or greenish elytra, and rufous prothorax with two small rounded or oval black spots. As indicated by Horn, the color of the legs may be either entirely black or the femora may be in part red; the venter also may be nearly entirely reddish or distinctly maculate with black. The basal joint of the ♂ antenna as viewed from the front is oblong with the upper edge arcuately emarginate throughout, the upper basal angle prominent; the posterior face is excavate. The second joint, viewed from beneath, is longer than wide, the appendix long.

The species ranges from Kansas to the desert regions of southern California. The following localities are represented in the material at hand: Kansas (Wallace); Colorado (Boulder); New Mexico (Cloudcroft, Santa Fé, Highrolls); Utah (Douglass, Stockton, Eureka); Arizona (Chiricahua Mts., Bright Angel).

C. limbatus G. & H. Col. Heft., VI, p. 121.

C. limbatus Lec. Smith. Miscel. Coll., 1863-66, VI, p. 94.

Head greenish black, pale yellow in front as far as the eyes, prothorax immaculate, elytra dark blue or green with the suture and entire apical and lateral margins pale. Antennae strongly serrate, entirely pale in the ♂, the outer joints more or less dusky in the ♀. Venter pale yellow with lateral black spots in the ♀, the latter feeble or absent in the ♂; legs varying from entirely pale except the hind femora to dark with the front and middle femora pale. The basal joint of the ♂ antenna is robust, triangular, somewhat longer than wide, not excavate posteriorly; second joint wider than long, appendage rather long.

This is a pretty species, best known by the broad parallel elytral vittæ and widely serrate ♂ antennæ. The type is from Nebraska. Other localities known to me are Wallace, Kansas (Knaus); Brownsville, Texas (Schaeffer); Pecos, Dimmitt Lake, and Roswell, New Mexico (Cockerell); Tucumcari, N. Mex. (Wickham); Clear Lake, Utah (Wickham); Independence, California (Wickham). The Brownsville and Independence specimens are not quite typical but do not appear to be specifically distinct; the latter has a small thoracic spot.

C. georgianus Fall. Trans. Amer. Ent. Soc., XXXVI, 1910, p. 141.

In the color of the head and the entirely pale under surface and legs, this species is almost unique. Certain specimens of *marginellus* have the head in part or entirely pale and the under body and legs also completely pale, but in these the prothorax is polished and the elytral margins entirely yellow. The antennal characters are almost precisely as in *tricolor* and *sublimbatus*.

Georgia. I have seen only the single pair from which the description was drawn.

C. flavicinctus Fall. Trans. Am. Ent. Soc., XXXVI, 1910, p. 140.

This species is at once distinguished from all others described by the long erect hairs being entirely pale. The head is pale yellowish testaceous in front of a line joining the middle of the eyes; prothorax black, highly polished, with very narrow pale side margins; elytra blue-black narrowly margined throughout with pale yellow, surface a little uneven and feebly shining. Antennæ pale yellow, outer angles of intermediate joints slightly infuscate. Tarsi and hind

legs blackish, front and middle femora and tibiae pale. Body beneath black, the margins of the ventral segments narrowly pale. Length $3\frac{1}{2}$ mm.

The unique type is a ♀ taken by Snow at San Bernardino Ranch, Douglas, Arizona.

Specimens collected by Dr. Fenyes at Olancha, California, and by Professor Wickham at Clear Lake, Utah, are placed here provisionally. In elytral vestiture they agree with the type but the surface of the elytra is more shining and green instead of blue.

C. laticollis Horn. Trans. Am. Ent. Soc., 1870, p. 83.

The only specimens of this species known to me are in the Horn and LeConte collections, and all are from the Lower California Peninsula. The head is finely, rather closely punctate, the setigerous punctures not apparently coarser; the prothorax is immaculate, the pale lateral and sutural margins of the elytra are continuous around the apex; the venter is entirely red except the sixth segment; the elytra show the little faint tuberculiform elevations scattered over the surface. The prothorax is quite strongly transverse, but careful measurements of the two examples in the LeConte collection show it to be only $\frac{3}{5}$ wider than long, though Horn says twice as wide as long in his description. The antennae are entirely pale in the ♂, blackish in the ♀, with joints 2-5 pale along the upper edge. Basal joint in ♂ not impressed on posterior face, subtriangular and about $\frac{1}{3}$ longer than wide as viewed from the front, the front face somewhat concave; second joint strongly transverse. The form of the basal joint is not very unlike that in *vittatus* but the second joint of the latter species is as long as wide.

C. granellus, new species.

Very similar in a general way to *laticollis* and the duller western forms of *vittatus*, but differing from the latter by the very obviously tuberculate elytra, and from both by the blue elytral vitta involving almost the entire apex. The basal joint of the antenna (♂) is nearly as in *vittatus*, triangular, slightly longer than wide, the supero-anterior face flattened (but not concave), posterior face not excavate. The second joint is distinctly transverse though less strongly so than in *laticollis*, the appendage short as in the allied forms. Venter red, without or with but faint traces of lateral spots. Legs almost entirely black in the ♀, the front and sometimes the middle thighs more or less pale in the ♂. The size is rather greater than either *vittatus* or *laticollis*; length $4\frac{1}{2}$ -5 mm.

This is apparently a rather common species in southern Arizona and is known to me from the Chiricahua Mts. (type), Santa Rita Mts. (Snow), Nogales (Schaeffer), Dragoon Mts., Pierce and Pinal Mts. (Wickham); also from St. George, Utah (Schaeffer).

I had regarded this species as a slight variety of *laticollis*, but the constant difference in the elytral vittæ, and small differences in

the first and second antennal joints in the ♂, warrant its separation, at least until intermediate forms turn up.

C. marginellus Lec. Proc. Acad. Nat. Sci. Phila., 1852, p. 164.

This species seems to be distinctly smaller than the most nearly allied forms, the length of all specimens seen varying but little from $3\frac{1}{2}$ mm. Its most characteristic feature is the form of the basal antennal joint in the ♂; this is very broadly ovate triangular, about as wide as long, thick, not much flattened in any aspect. The second joint is about as long as wide. In the type the pale frontal margin is wide, the prothorax is black with narrow pale margin; elytra dull, not tuberculate, pale margin continuous around the apex; venter entirely pale; legs in great part blackish. The elytral vittæ are variable in width and the head, thorax, under surface and legs vary through intermediate stages to entirely pale.

I have seen but few specimens and all from the same region—the lower Colorado River. Professor Wickham has taken the species at Needles and Yuma on the California side of the river.

C. vittatus Say. Jour. Acad. Nat. Sci. Phila., III, 1823, p. 184.

This species varies greatly in the minor details of form, color and sculpture and shows a marked tendency to develop races which are to a considerable extent geographical. The thoracic spot may be large or small, is often divided into two smaller ones and is not infrequently entirely wanting. The elytral vittæ are fairly constant and in my experience never completely interrupted, the lateral, apical and sutural pale margins continuous. The basal antennal joint is subtriangular, about $\frac{1}{3}$ longer than wide, not impressed posteriorly, more or less flattened anteriorly; second joint narrower than usual, as long as wide, appendix short. In specimens from the North-eastern States the punctuation is relatively coarse, the surface shining throughout, antennæ of both sexes more or less infuscate, legs almost entirely black. In specimens from the arid southwest the size is somewhat larger, the punctuation finer, surface of elytra less shining or even quite dull, antennæ of ♂ entirely pale, legs more or less pale. In Dakota, Montana, Colorado and some parts of Texas and Arizona perfectly intermediate forms prevail and I have found it practically impossible to define well-limited varieties.

Including its varietal or racial forms *vittatus* is very widely dispersed, occurring from Quebec to Saskatchewan and Arizona. It is not equally common and perhaps not continuous throughout its range.

Say described the species somewhat vaguely from the Mississippi region. It is not rare in parts of New England and Ulke records it from the District of Columbia as does Wickham from Iowa, but it is not given in the New Jersey, western Pennsylvania or Cincinnati lists, nor is it mentioned by Blatchley in his Coleoptera of Indiana. Specimens are known to me from Quebec (Rigaud), Maine, New Hampshire, Massachusetts, Michigan, Nebraska, Dakota, Montana, Saskatchewan, Colorado, Utah, Texas and Arizona.

C. necopinus, new species.

Head greenish black, labrum and clypeus pale; antennae entirely pale (δ), or blackish, with the basal joint and joints 2-4 in part pale (φ). Prothorax rufous with discal black spot, sometimes involving all but a narrow margin. Elytra dark blue, the median portions of the sutural and lateral margins very narrowly rufous; prosternum rufous, meso- and metasternum black; venter rufous, sides heavily maculate with black; legs black, the front femora rufous; the front tibiae and middle femora also frequently more or less pale. Head very finely punctate, moderately shining; prothorax polished with a few minute scattered punctures, most noticeable at sides; elytra densely, moderately strongly punctured and moderately shining.

Male.—Basal joint of antennae rather robust, ovate-triangular as viewed from the front, evidently longer than wide, a little flattened on its anterior face; second joint scarcely as long as wide, appendix rather short, outer joints not very strongly serrate.

Female.—Second antennal joint stout, not much longer than wide, wider than those following and scarcely as long as the next two. Length $3\frac{1}{2}$ - $4\frac{1}{2}$ mm.

Southern California—San Diego (type), Pomona, San Bernardino, Claremont, Laguna Beach.

A series from Campo, San Diego Co., on the edge of the desert differs in having the elytra green instead of blue, and in having the narrow sutural pale stripe almost obliterated; these appear to me to be only a local variety. This is perhaps the commonest species of the genus in southern California. It possesses very nearly the structural characters of *vittatus* and may be an extreme form of that variable species; the color differences are however apparently constant, the surface more shining than in the western forms of *vittatus* and the second joint of the antennae in the δ is relatively wider.

C. punctulatus Lec. Proc. Acad. Nat. Sci. Phila., 1852, p. 165.

A small depressed species, varying in length from $2\frac{3}{4}$ to 4 mm. and differing from all others in our fauna by the prothorax being finely evenly alutaceous and dull throughout, with fine, sparse, evenly distributed punctuation. The

head and elytra are also alutaceous, the former unusually coarsely and closely punctate, the elytra as a rule rather sparsely and finely punctate, but more coarsely so than the prothorax. The color is very variable. In the type the head and prothorax are black, the latter with side margins pale, very narrowly so at middle, more broadly so at the angles; elytra each with broad bluish black vitta, narrowed at basal third, the sutural, apical and lateral margins almost to base, pale; venter black; femora black, tibiae and tarsi pale. The prothorax varies from entirely black to entirely pale, the elytral vittæ may be black, bluish or greenish and are often completely interrupted; in one example in my collection from Santa Rosa, Cal., the prothorax and elytra are entirely black; the legs vary to almost entirely black. Several names have been given to color varieties and others might be given with equal propriety—or lack of it.

Var. *insulatus* Lec. Smith. Miseel. Coll., 1865, p. 94.

Elytra quadrimaculate, prothorax rufous with broad median black stripe. The type is considerably above the average size (4 mm.) but I have seen very similar smaller examples.

The type is from California; a second example in the LeConte cabinet is from New Mexico; I have seen it also from the Santa Rita Mts., Arizona.

Var. *utahensis* Schaeff. Can. Ent., 1912, p. 187.

This is *insulatus* with the prothorax entirely black.

The type is from South Creek, Beaver Co., Utah. It is known to me also from St. George and Nephi, Utah, and from "Col." and Rifle, Col.

Var. *texanus* Schaeff. Can. Ent., 1912, p. 187.

This again is *insulatus* with the prothorax entirely rufous. The type is from Brownsville; it has also been taken by Professor Wickham at Tucson, Arizona.

The species is quite widely distributed in the southwest, occurring from "Missouri Territory" (type) and Brownsville, Texas, to California. The following specific localities are known to me: Texas—Brownsville, El Paso; New Mexico—Las Cruces; Arizona—Santa Rita Mts., San Bernardino Ranch, Tucson; Colorado—Rifle; Utah—Clear Lake, St. George, Nephi, South Creek; Nevada—Sutro; California—Santa Rosa, Pasadena, Pomona.

C. *validus* Horn. Trans. Am. Ent. Soc., 1870, p. 82.

Our largest species, and unapproached in size by any other of ours with maculate elytra except the larger specimens of *balteatus*. The size, together with the bimaculate prothorax and entirely pale legs, are entirely characteristic. With the exception of *scutellatus* and certain specimens of *pulchellus* all other species of this group have the legs, at least in part, black.

Described from Sonora in northern Mexico. Occurs also in the peninsula of Lower California.

C. crusoe Fall. Trans. Am. Ent. Soc., XXXVI, 1910, p. 140.

Apterous, humeri narrow. Head rufous (δ) or with sides blackish (φ); prothorax rufotestaceous, immaculate, densely subrugosely punctate and dull; elytra yellow, each with an elongate basal, and a larger posterior spot bluish black, the entire limb and suture yellow, punctuation dense and coarse; legs bicolored. The basal antennal joint in the δ is evidently longer than wide and somewhat excavate posteriorly.

San Nichols Island—coast of southern California. The narrow humeri, absence of wings, maculate elytra with basal spot unusually narrow and reaching neither suture nor margin are quite characteristic. Our only other apterous species is *cribosus*.

C. pulchellus Horn. Trans. Am. Ent. Soc., 1870, p. 83.

Bright rufous, head except the labrum and epistomal margin bluish or greenish black; elytra with basal and subapical dark blue spots, which though variable in size are as a rule smaller than in the other 4-maculate species. Antennae entirely pale in the δ , basal joint elongate and distinctly excavate posteriorly; second joint somewhat transverse with long claw-like appendage; 3-10 feebly serrate. In the φ the antennae may be entirely pale, or with joints 3-10 more or less dusky; second joint unusually elongate, twice as long as wide or very nearly so, and fully as long as the next two. Prothorax entirely rufous, usually subimpunctate and strongly shining; elytra very densely and rather coarsely punctate; venter entirely pale; legs pale throughout or with the tibiae dusky.

Arizona. The type from Ft. Grant; other examples from Phoenix and Riverside. El Paso, Texas.

C. histrio Er. Entom., p. 59.

C. argutus Fall. Occ. Pap. Cal. Acad. Sci., VIII, p. 242.

A little larger as a rule than *4-maculatus*, the elytral spots larger, usually feebly bluish or greenish, sometimes narrowly confluent, and rarely involving the entire surface except the middle of the suture and lateral edge. Prothorax immaculate, typically closely punctulate but polished except near the side margins, but varying to more coarsely and densely punctate and entirely dull. Head closely punctate, elytra very densely moderately coarsely punctate. Venter varying from almost black to entirely red; legs black. Antennae black except at base; basal joint in the δ sinuate posteriorly, appendage of second joint very long; second joint of φ elongate, not much dilated.

The type was from Eschscholtz and was probably taken at no great distance from San Francisco. The species is known to me from

Sierra Co., Lake Co., Contra Costa Co., Los Angeles, Pasadena, San Diego and Poway, California; also from Johnson's Cañon, Prescott and the Huachuca Mts. in Arizona, and Ft. Wingate, New Mexico.

With the possible exception of *insulatus* no other species in our fauna is so generally misunderstood as the present one. As every 4-maculate species of the Pacific Coast and Southwest goes as *histrio* in one collection or another, it is of course sometimes correctly identified. Erichson's description is very brief, and Horn's remarks are still briefer and misleading, his tabular character "thorax densely finely punctured and opaque" being based on an extreme variant of the species and not warranted by Erichson's description, which states that the thorax is shining. At the time I described *argutus* my conception of *histrio* was based upon Horn's statement, and I was not then aware of the fact that the sculpture of the prothorax in *Collops* may vary greatly within specific limits. I am now convinced that *argutus* is identical with, and in thoracic punctuation not very far from the true *histrio*, the type of which probably lies between it and Horn's "*histrio verus*." In the LeConte collection, which I have recently examined, the label *histrio* is placed on a typical *argutus* ♀, and with it is the Lower California specimen alluded to by Horn, and which bears the label "*histrio verus*" in his handwriting. There is a third specimen—a ♀—mixed with *pulchellus*. *Histrio* and *pulchellus* are very closely allied and the antennal characters in both sexes are virtually identical. The latter species is rather smaller and less robust, of a bright red color, with elytral spots as a rule much smaller and never confluent—so far as I have seen; the abdomen is red and the legs are entirely or predominantly so. In *histrio* the legs are black and the abdomen is usually heavily maculate.

C. scutellatus Schaef. Can. Ent., 1912, p. 186.

Pale reddish yellow, metasternum black, head with a small central bluish spot, elytra each with a basal and large oval posterior spot, blue, the spots narrowly separated; scutellum rufous. Head distinctly but finely punctate, prothorax finely rugulose at sides, polished and subimpunctate at middle; elytra feebly shining, closely rather finely punctate. Basal antennal joint (δ) fully $\frac{1}{2}$ longer than wide, feebly dilated outwardly, subcylindrical in apical half, not impressed posteriorly; second joint subtriangular as viewed from beneath, about as long as wide, appendix long; outer joints feebly serrate. Length $3\frac{1}{4}$ mm.

New Braunfels, Texas.

I have seen the unique ♂ type which is quite distinct in color from anything else known to me.

C. similis Schaeff. Can. Ent., 1912, p. 187.

Pale rufous, moderately shining, elytra 4-maculate. Head black, pale in front as far as the eyes, finely punctulate. Prothorax entirely red, polished, with a few fine punctures especially toward the sides. Elytra closely but not very coarsely punctate, the spots blue or green, the posterior one larger and oval not attaining the margins. Venter pale red without obvious lateral spots; four anterior legs red, hind legs black, the hind thighs rufescent basally. Antennæ (♂) moderately serrate, pale throughout or with outer joints slightly dusky; basal joint subtriangular, a little longer than wide, rather thick, not excavate posteriorly, not very unlike that in *vittatus*; second joint slightly wider than long, appendage short.

I have seen only two examples of this species, both ♂'s; one a cotype from Mr. Schaeffer labeled simply Utah, the other from St. George, Utah, collected by Wickham.

C. tibialis Schaeff. Can. Ent., 1912, p. 186.

Very similar in form, size and color to *♀-maculatus*, the upper surface bright rufotestaceous, the head black, labrum, epistoma and frontal margin yellow, the latter trilobed in its posterior outline, the lateral lobes extending to the eyes, the middle one to a little beyond a line tangent to the anterior margins of the eyes. Antennæ blackish in both sexes, the basal joint alone pale in the ♂, the second and third partly so in the ♀. Prothorax immaculate and nearly smooth, elytra densely punctate and rather dull, the spots large, blue, either separated or narrowly longitudinally confluent, the posterior spots rather broadly involving the lateral margin. Abdomen bright red with large lateral black spots; legs black throughout or with tibiæ and tarsi red. Length 3½-4 mm.

Chiricahua Mts., Arizona, 3 ♂'s, 1 ♀. Nogales, Ariz., 1 ♀ (Wickham); Ft. Wingate, New Mexico (Liebeck).

This species is very like *♀-maculatus* but differs in many details. In addition to those mentioned in the table, it may be said that the color is rather brighter, the basal antennal joint in the ♂ is not quite so thick and the dilated joint is a little different in form and with much longer appendage. In all of the males seen the elytral spots are confluent, not so in the two females. In the series from the Chiricahuas the legs are entirely black; in the Nogales ♀ the tibiæ and tarsi are rufous. In a specimen from Ft. Wingate, New Mexico (Liebeck Coll.), the prothorax has two small discal black spots.

C. confluens Lec. Proc. Acad. Nat. Sci. Phila., 1852, p. 164.

A little smaller than *vittatus* and with the elytra rather narrower at the humeri and more oval. Head quite distinctly and rather closely punctate, with the coarser setigerous punctures strongly conspicuous. Prothorax immaculate, sides more or less broadly rugulose and dull, median parts polished and finely sparsely punctate. Elytra coarsely and very densely punctate, dull, the spots rather narrowly confluent in typical form, but often separate, the anterior ones triangular and not involving the suture at base, the posterior ones oval and not attaining either suture or side margin. Venter pale rufous with terminal segment blackish (type) or with faint lateral shades or spots. Thighs dusky, tibiæ and tarsi dull rufous in the LeConte type, the front and middle thighs paler in a second example. The antennæ are blackish, testaceous at base, basal joint (δ) slender, elongate, not excavate posteriorly; second joint longer than wide when viewed from beneath, the appendage long but less stout than in *histrio*. The second joint in the ♀ is narrowed and fully as long as the next two, nearly as in *fulchellus* and *histrio*.

The type was described from "Missouri Territory" (Kansas). Specimens before me are from Kansas; Wallace, Kansas (Knaus); Texas; Marfa, Texas (Wickham); Santa Fé, New Mexico (Fenyes); City Cañon, Utah (Knaus); Utah (Liebeck).

C. femoratus Schaeff. Can. Ent., 1912, p. 186.

Closely allied to *4-maculatus* and should intermediates occur may have to be united with it. It differs from *4-maculatus* in its somewhat larger size, denser elytral punctuations with duller surface luster, the usually entirely red abdomen in the ♂, and in having the legs bicolored instead of black. In the type the front and middle femora and the hind femora at base are red; in another example the tibiæ are also in part rufescent. The ♀'s, according to Schaeffer, have the abdomen spotted with black. Length $4\frac{1}{2}$ mm. (head deflexed).

Arizona—Huachuca Mts. (type); Tucson (Wickham); Nogales (Nunnenmacher).

C. 4-maculatus Fab. Ent. Syst. Suppl., 70.

This is a rather large species, of about the same size as *bipunctatus*. I have seen but few specimens, and these exhibit almost no variation. The elytral spots are so large that it may best be described as having the elytra blue with a narrow border and a transverse fascia at anterior third, yellow or rufous. The basal antennal joint in the ♂ is thick, subtriangular, scarcely longer than wide, and sinuate on its posterior face; the second joint is more narrowed apically than in any other species known to me, and is very plainly longer than wide. The legs are almost entirely black, the venter heavily maculate.

C. balteatus Lec. Proc. Acad. Nat. Sci. Phila., 1852, p. 230.

This is a rather large species, of about the same size as *bipunctatus*. I have seen but few specimens, and these exhibit almost no variation. The elytral spots are so large that it may best be described as having the elytra blue with a narrow border and a transverse fascia at anterior third, yellow or rufous. The basal antennal joint in the ♂ is thick, subtriangular, scarcely longer than wide, and sinuate on its posterior face; the second joint is more narrowed apically than in any other species known to me, and is very plainly longer than wide. The legs are almost entirely black, the venter heavily maculate.

It is known to me only from Texas.

C. versatilis, new species.

Male.—Head and thorax black, labrum and antennæ pale; elytra reddish yellow each with a small basal and a larger subapical spot dark blue; body beneath black, the margins of the ventral segments narrowly rufous; legs black, all the tarsi and the front tibiae pale, middle tibiae dusky. Basal joint of antennæ sinuate posteriorly, second joint fully $\frac{1}{2}$ wider than long, outer joints feebly serrate. Head shining, sparsely very finely punctate posteriorly, the punctures a little larger and closer anteriorly. Prothorax $\frac{1}{2}$ wider than long, sides feebly arcuate and subparallel in middle two-thirds, disk polished and very minutely and remotely punctulate medially, becoming somewhat abruptly dull and a little uneven in about the lateral fourth. Elytra finely punctate, not distinctly scabrous, the punctures separated by from one to two times their diameters. The basal spots are strictly basal, rounded behind and attain both the side margin and the scutellum.

Female.—Similar to the male, the antennæ of the usual type in this sex, the clypeus and the middle tibiae pale. Length 4-5 mm.

The male and female types described above were taken at Cole in northern California by Dr. Fenyes. With them I place specimens from Lake Co., Contra Costa Co., Sonoma Co., Santa Rosa (Rickscker), Mokelumne Hill, Alameda Co., Pomona and Pasadena in California; Oregon; City Cañon, Utah; and Arizona.

If the specimens united under this name are conspecific, and I have no doubt of this, the species is an exceedingly variable one in coloration. In two of the three Lake Co. ones the prothorax is entirely pale, in the third pale with a discal black spot, and in these the legs vary from entirely pale except the hind femora to entirely black except the tarsi. In the Utah specimens the prothorax is black with a narrow pale margin; in one from Contra Costa Co., Cal., there

are two small widely separated spots; in all those from southern California it is immaculate. The elytral spots vary much in size and in the Oregon examples coalesce into a broad vitta narrowed a little before the middle; the spots are sometimes dark green instead of blue.

Some specimens are colored nearly as in *insulatus* and were once somewhat generally distributed as such by Ricksecker.

GALL-FLY PARASITES FROM CALIFORNIA.

BY DAVID T. FULLAWAY,

HONOLULU, HAWAIIAN ISLANDS.

While at Stanford University, in 1910, I had an opportunity to study a fine collection of cynipid gall-flies collected by Mrs. Rose Patterson Blakeman. This collection was made by Mrs. Blakeman when a student in the University in 1905-6-7, and contains most of the described species from California. The collection also includes the parasitic species bred from the galls, but this material I was not able to examine carefully until recently. Although there is nearly as much parasitic as host material in the collection, I can distinguish only a few species, which are described herewith.

CHALCIDOIDEA.

TORYMIDÆ.

TORYMINÆ.

SYNTOMASPIS Förster.

S. californica Ashm.?

Female.—Length 4.5 mm., ovipositor 7.5 mm., expanse of wings 9 mm., greatest width of fore-wing 2 mm. Head and thorax (except mesopleura posteriorly and metathorax, which are smooth and shining) rather coarsely transversely rugose, the mesonotum, axillæ and scutellum in front of the transverse line which divides it beyond the middle, with very coarse umbilicate punctures; these much finer and largely effaced on head and pronotum; scutellum beyond the transverse line shagreened; all covered with a whitish pubescence which is especially marked on face and metathorax laterally; abdomen and legs smooth and shining, but microscopically reticulate, coxæ rather coarsely so, with a few sparse hairs.

Head transverse, slightly wider than the thorax, rather thin anterior-posteriorly, occiput completely margined, front broad between the eyes, which are large and bulged, face broadening slightly below, cheeks extremely thin in front, separated from face by a groove, broad behind eyes to occipital margin, ocelli almost in a straight line, antennæ inserted on the middle of the face, 11-jointed (scape, pedicel, 1 ring-joint, 7 jointed funicle and undivided club), joint measurement in mm. 1 .39, 2 .1, 4-10 .17-.18, 11 .3. Thorax broad, convex, pronotum fairly long, narrowing anteriorly, mesonotum a little longer than scutellum, parapsidal grooves distinct, scutellum rhomboidal, divided beyond the middle by a transverse line, metathorax and sides of scutellum anteriorly sloping abruptly. Abdomen not quite so long as head and thorax together, greatly compressed, elongate elliptical from above, hatchet-shaped from side, the segments telescoping, the four first dorsally ridged with the posterior margins incised, ovipositor projecting from tip of dorsum and elevated, sheaths clothed with short hairs. Legs stout and hairy, the hind coxae, femora and tibiae especially broad and flat, the outer edge of the coxae quite sharp, femora faintly serrate on lower margin.

Brilliant metallic green with æneous and purplish reflections, antennæ fuscous brown, almost black, eyes and mandibles red, legs outwardly from coxae reddish brown, ovipositor sheath black.

Wings hyaline, veins light brown, submarginal nearly a third longer than the marginal, which reaches beyond the middle of the costal border, stigmal vein undeveloped—a mere blob on the marginal, postmarginal vein also short, the disc pubescent with quite evident hair lines.

From *Andricus quercus-californicus*, *Callirhytis quercus-pomi-formis* and strawberry gall on *Quercus dumosa* and pimply gall on *Q. douglasii*, from which no gall-flies were bred.

Described from many specimens in Coll. L. S. J. U. (Lot 497, s. 8).

S. cærulea, new species.

Length 4 mm., ovipositor 3.5 mm., expanse of wings 8 mm., greatest width of fore-wing 1.5 mm. Head and thorax finely transversely rugose, with a short, closely appressed whitish pubescence; front of head, scutellum and mesonotum posteriorly with an almost effaced umbilicate punctuation, face, cheeks and anterior margin of the metathorax conspicuously hairy, metathorax, abdomen and mesopleura behind femoral furrow smooth and shining, the abdomen microscopically reticulate.

Head transverse, wider than thorax, rather thin anterior-posteriorly, occiput completely margined, front broad between the eyes, which are large and bulged, face also broad, cheeks extremely thin, ocelli arranged in an obtuse triangle, antennæ inserted on middle of face, 11-jointed (scape, pedicel, 1 ring-joint, 7 jointed funicle and undivided club), joint measurement in mm. 1 .47, 2 .11, 4 .2, 5 .18, 6-8 .16, 9 .15, 10 .13, 11 .27. Thorax broad, slightly convex, pronotum short, parapsidal grooves distinct, scutellum more or less angulate and truncate behind, divided by a transverse line just beyond the middle, behind which the

surface is shagreened, metathorax only slightly convex. Abdomen not quite as long as head and thorax together, very much compressed beneath, short elliptical and rather broad from above, triangular from side, truncate at apex of 4th segment, following segments projecting dorsally and the rather long ovipositor elevated, 1st segment distinctly and the following two more or less incised apically. Legs hairy, hind coxae enlarged, hind femora broad and flat, faintly serrate and with a distinct tooth near apex.

Blue green to green and blue with some purplish reflections, antennal scape at base, mandibles, tegulae, tibiae and tarsi golden brown, eyes and ocelli red, terebra reddish brown, antennae beyond scape and ovipositor sheaths black, the latter hairy.

Wings hyaline, pubescent, with some very evident hair lines, marginal vein long, nearly as long as submarginal, postmarginal a trifle longer than stigmal, all the veins brown except stigmal which is black.

From gall of *Callirhytis quercus-agrifoliae* (Bass.), *Andricus quercus-californicus*, and pimply gall on *Q. douglasii* from which no gall-flies were bred.

Described from many specimens in Coll. L. S. J. U. (Lot 499, s. 3).

This species has some characters which would exclude it from the group in which it is placed and for a long time I was inclined to consider it as belonging to the genus *Cryptopristus* Först. in the next sub-family, but it has the wings of a genuine Torymine and in any event is so like the preceding that it would naturally go with it.

ORMYRINÆ.

ORMYRUS Westwood.

O. distinctus, new species.

Female.—Length 3.5 mm., expanse of wings 6 mm., greatest width of forewing 1 mm. Faintly reticulately rugose, the fine sculpture of head and thorax running transversely, reticulate sculpture of abdomen more pronounced; also finely punctate and covered with pubescence; mesopleura behind femoral furrow, 1st abdominal segment medially and all the segments narrowly at apex smooth and shining.

Head transverse, slightly wider than thorax, fairly thick anterior-posteriorly, eyes moderate and convex, ocelli arranged in an obtuse triangle, front wide between the eyes, face not narrowed, cheeks broad, separated from face by a groove extending from lower margin of eye to base of mandibles, antennæ inserted on middle of face, only scape, pedicels, ring-joint, and 6 funicle joints present. Thorax convex, pronotum about half the length of the mesonotum, the latter without parapsides, axillæ widely separate, scutellum convex, elongate, hind margin truncate but rounded from oblique sides, slightly emarginate posteriorly, the margin overhanging melanotum and indistinctly costate, the meta-

thorax sloping abruptly, almost smooth, with a distinct longitudinal carina on either side of the median line. Abdomen fairly broad and elongate, narrowing gradually beyond the middle to a fine point, ridged dorsally from basal margin of 2d segment to apical margin of 4th, some deep punctures at base of 3d and 4th segments and a transverse row of broad shallow costæ anteriorly on 2d, 3d, 4th and 5th segments, each with a fringe of long procumbent hairs posteriorly. Sheath of ovipositor broad and flat, slightly protruding. Legs stout and hairy, hind coxae greatly developed.

Metallic green with some purplish reflections, head and thorax bluish green, hind trochanters, knees, tips of tibiæ and tarsi reddish to yellowish, antennæ black and hairy. Wings hyaline, marginal vein nearly as long as submarginal, stigmal vein short, postmarginal somewhat longer; all brownish.

From strawberry gall on *Quercus dumosa* from which no gall-flies were bred.

Described from one specimen in Coll. L. S. J. U. (Lot 497. s. 5).

EURYTOMIDÆ.

EURYTOMINÆ.

EURYTOMA Illiger.

E. incerta, new species.

Female.—Length 4.5 mm., expanse of wings 7.25 mm., greatest width of fore-wing 1.35 mm. Head and thorax closely umbilically punctate, rather thickly clothed with a silvery white pubescence, prothorax laterally, hind coxae outwardly and mesopleura above shagreened, the latter aciculate below, abdomen smooth and shining, segments 1, 2, 3, 4 basally, 5, 6, 7 entirely microscopically punctate and sparsely clothed with silvery hairs. Head transverse, front wide between the eyes, which are small, face also broad, ocelli arranged in an obtuse triangle, antennæ inserted on middle of face, 9-jointed (1 ring-joint and an undivided club), joint measurements in mm. 1 .33, 2 .12, 4 .18, 5, 6 and 8 .13, 7 .12, 9 .32. Thorax convex, almost tuberculate, pronotum as long as mesonotum, parapsidal grooves distinct, scutellum convex, rounded posteriorly, metathorax sloping abruptly, depressed in the middle. Abdomen compressed, elongate elliptical from above, triangular from side, apically produced to a fine point, 4th segment widest, wider than 2 and 3 together, sheaths of the ovipositor broad, slightly protruding. Legs pubescent, hind coxae enlarged.

Black, mandibles, base of scape outwardly, tip of ovipositor sheaths and legs (with the exception of the femora and tibiæ outwardly) brown (only base and apex of hind femora and tibiæ brown). Wings hyaline, marginal vein short, postmarginal vein nearly as long, but stigmal shorter, ending in a club.

Male.—Length 3.75 mm. Like the female but the funicular joints of antennæ nodose, pedicellate at apex, each node with two whorls of long hairs. Club not quite as long as scape but longer than funicle joints, which are all sub-equal, pedicel very small and obconic. Abdomen long petioled, much reduced in size and rather hatchet-shaped. Petiole broad and flat and shagreened.

From large pointed gall on rose from which no gall-flies were bred.
Described from 4 ♀♀ and 1 ♂ specimens in Coll. L. S. J. U. (Lot 499, s. 23).

E. querci, new species.

Female.—Length 2.5 mm., expanse of wings 4 mm., greatest width of fore-wing .92 mm. Similar to preceding but 1st funicle joint not longer than 2d, abdomen less markedly produced at apex, only extreme base of antennal scape brown, postmarginal vein of wings no longer than stigmal.

From disc-shaped galls of *Callirhytis guadaloupensis* Full. on under side of leaves of *Quercus chrysocarpis*.

Described from one specimen in Coll. L. S. J. U. (Lot 508, s. 45).

A male specimen with corresponding characters, although from a different lot (Lot 509, s. 20 ex fuzzy gall of *Callirhytis lasia* Ashm. on *Quercus chrysocarpis*) is 2.5 mm. long, funicle joints somewhat incised and hairy but not nodose, pedicellate at apex, with two whorls of hairs.

DECATOMINÆ.

DECATOMA Spinola.

D. kelloggi, new species.

Female.—Length 2.75–3 mm., expanse of wings 4.35 mm., greatest width of fore-wing .92 mm. Head and thorax (including petiole) umbilically punctate, thickly clothed with whitish pubescence, which is lengthened on the mesosternum, mesopleura below and anteriorly on metathorax into a silvery fringe. The sculpture of the face, cheeks and petiole is rather shallow, mesopleura aciculate, abdomen smooth and shining with a few sparse hairs. Head slightly wider than the thorax, transverse and fairly thick anterior-posteriorly, eyes small, face broad, cheeks emarginate, front wide between the eyes, ocelli arranged in an obtuse triangle, antennæ inserted on level with lower margin of eyes, rather broad and deep antennal groove on face almost reaching lower ocellus, antennæ 9-jointed (one ring-joint and an undivided club). Thorax convex, almost tuberculate, pronotum as long as the mesonotum, parapsidal grooves present but indistinct, scutellum rounded posteriorly and very convex, metanotum sloping abruptly, with a shallow fovea at the base smooth and shining. Abdomen compressed, elliptical from above, triangular from the side, petiole fairly long and broad, only five segments visible, 3d the widest, ventral valves evident but not protruding. Legs pubescent, hind tibiæ very thickly clothed with stiff white hairs, hind coxæ and femora very much swollen, a few long hairs on the former.

Reddish brown, the prothorax and legs paler, almost golden brown; mandibles, occiput largely with a narrow strip on cheek, the vertex and front of head, two lateral and two transverse stripes on the pronotum, mesonotum largely,

mesosternum, scutellum, metanotum, abdomen dorsally and laterally beyond the middle, all the femora and tibiae outwardly, middle and hind tibiae almost entirely black. Eyes brown. Antennae fuscous, the scape and pedicel golden brown, black above. Ocelli red. Wings hyaline, slightly iridescent, marginal vein short, stigmated, a brown gourd-shaped cloud extending across the middle of the wing two thirds its width, the short capitate stigma projecting from the outer side of the neck.

From twig swelling on *Quercus chrysocarpa* from which no gall-flies were bred.

Described from two specimens in Coll. L. S. J. U. (Lot 509 s. II).

A single male specimen corresponding closely in structure was bred from the gall of *Disholcaspis eldoradensis* collected in the vicinity of Stanford University. The following slight differences are noted:

Slender, greatest width of fore-wing .76 mm. Antennae 8-jointed (only 4 joints in funicle), the club slightly enlarged, metanotum more or less flat, abdomen not compressed ovate dorsal margin (from side) semicircular, ventral margin straight, 3d segment occupying half the abdomen, 4th and 5th rather inconspicuous; hairy, black on head beyond ocelli, on to face, and on vertex beyond eyes, thorax also black except lateral angles of pronotum and narrow strip in front, and mesopleura.

D. doanei, new species.

Female.—Length 2.75 mm., expanse of wings 4.25 mm., greatest width of fore-wing .90 mm. Head and thorax umbilically punctate, rather thickly clothed with silvery pubescence, which is longer on mesosternum and laterally on metathorax; mesopleura faintly shagreened in front, aciculate behind, petiole only faintly rugose; abdomen smooth and shining, with a few sparse hairs. Head triangular (when viewed from in front), slightly wider than the thorax, transverse and fairly thick anterior-posteriorly, eyes small, front between wide, ocelli arranged in an obtuse triangle, antennae inserted on level with lower margin of eyes, antennal groove broad and nearly reaching lower ocellus, antennae 9-jointed (one ring-joint and an undivided club). Thorax convex, almost tuberculate, pronotum as long as mesonotum, parapsidal grooves present but indistinct, scutellum rounded posteriorly and very convex, metanotum more or less flat, with a shallow fovea medially at the base smooth and shining. Abdomen compressed, elliptical from above, semicircular from side, the ventral line straight, petiole fairly long and broad, 7 segments visible, 3 and 4 wide, much wider than any of the others, ventral valve slightly protruding. Legs pubescent, hind tibiae very thickly clothed with hairs and with a row of stiff bristles on posterior face, hind coxae and femora very much swollen.

Black, a line around the eyes and continued on to the face into antennal groove, anterior face and sides of prothorax, tegulae and a thin stripe above, mesopleura, base and sides of abdomen reddish brown, antennae fuscous, scape and pedicel reddish brown, black above. Ocelli red. Legs pale reddish brown, outer faces of coxae, femora and tibiae marked with black, which is more extensive on posterior pair.

Wings hyaline, faintly iridescent, marginal vein short, stigmated, postmarginal and stigmal veins about equal and quite short, a thin brown, parallel-sided band reaching two thirds across wing.

From gall of *Disholcaspis eldoradensis* on *Quercus dumosa*.

Described from one specimen in Coll. L. S. J. U. (Lot 509, s. 19).

D. gracilis, new species.

Male.—Length 2 mm., expanse of wings 3.15 mm., greatest width of forewing .70 mm. Head and thorax umbilically punctate, rather thickly clothed with whitish pubescence which is considerably lengthened on mesosternum, laterally on metathorax and outwardly on hind coxae; abdomen smooth and shining; petiole and mesopleura in front faintly shagreened, the latter behind aciculate. Head transverse, fairly thick anterior-posteriorly, eyes small, face broad, front wide between the eyes, ocelli arranged in an obtuse triangle, antennae inserted at lower level of eyes, 8-jointed (only 4 joints in funicle). Thorax convex, pronotum as long as mesonotum, parapsidal grooves indistinct, scutellum convex and rounded posteriorly, metanotum somewhat convex. Abdomen compressed, ovate from above, triangular from side, 3d segment longest, covering more than half the abdomen and enclosing those following, petiole fairly long and slender, tip of abdomen hairy. Legs pubescent, hind tibiae with rows of bristles on posterior face, fore and hind coxae and femora somewhat swollen, a few long hairs on hind coxae.

Black, the face anteriorly, pronotum (except for a median V-shaped black area anteriorly) and legs lemon yellow (mid and hind femora and tibiae and hind coxae outwardly marked with black); antennae brown beyond the pedicel. Wings hyaline, faintly iridescent, marginal vein short and stigmated, the stigma semicircular and black, stigmal vein slightly projecting.

From gall of *Andricus quercus-californicus*.

Described from one specimen in Coll. L. S. J. U. (Lot 508, s. 30).

EULOPHIDÆ.

TETRASTICHINÆ.

TETRASTICHUS Haliday.

T. pattersonae, new species.

Female.—Length 2 mm., expanse of wings 4 mm., greatest width of forewing .92 mm. Head and thorax faintly reticulately rugose with a system of

minute punctures, each puncture enclosing a hair, mesopleura behind and abdomen smooth and shining, microscopically reticulate. Head broader than thorax, extremely thin anterior-posteriorly, the ocelli on the vertex arranged in an obtuse triangle, a groove extending outwardly from these to eyes, which are small and convex, face between wide and sunken in middle, cheeks not very broad, separated from face by a well-defined groove, antennæ 7-jointed (scape, pedicel, 1 ring-joint, 3-jointed funicle and an undivided club), inserted at lower level of eyes, scape not quite as long as funicle, longer than club, which is somewhat expanded, the individual funicular joints and pedicel subequal. Parapsidal grooves on mesonotum distinct, a median groove posteriorly and four longitudinal grooves on scutellum, which is more or less truncate behind, followed by a thin post-scutellum. A median carina on metanotum bifurcating at about middle forming two large fields above. Abdomen short oval, depressed, concave in dry specimens, hind margin hairy, ovipositor not exserted. Legs fairly long, hairy.

Metallic green, legs lemon yellow outwardly from middle of femora, tips of tarsi black, eyes red, mandibles reddish brown, antennæ yellowish brown, somewhat infuscated. Wings hyaline, marginal vein as long as submarginal and fairly thick, stigmal vein short and the club capitate with a spur, postmarginal vein extremely short and pointed, ♂ antennæ clothed with long hairs and tip of abdomen with a short brown spur.

From gall of *Diplolcpis echina* O. S.

Described from 1 ♀ and 3 ♂ specimens in Coll. L. S. J. U. (Lot 508, s. 19).

T. stanfordiensis, new species.

Female.—Length 2.10 mm., expanse of wings 4 mm., greatest width of forewing .85 mm. Very similar in habitus to preceding but with fewer punctures and less hairy. Abdomen elongate, pointed at apex; median line on mesonotum extending the whole length of same.

Metallic green, tips of femora, tibiae and tarsi yellowish brown to sordid white; antennæ fuscous brown; stigmal vein in wing longer, with distinct spur.

From pimply gall on *Quercus douglasii*, from which no gall-flies were bred.

Described from one ♀ specimen in Coll. L. S. J. U. (Lot 497, s. 8).

There were also among the parasitic material two Pteromalids apparently belonging in the tribe Pteromalini; also an extremely interesting single male Torymid, apparently running to the genus *Oligosthenus* Först., black, metallic, rugose and hairy, with hairy eyes, a rather long stigma and a dusky spot below on disc, but the material was either insufficient or in too poor condition for description.

It may be interesting, also, to note that along with the gall-flies, inquilines and parasites, there were bred various Cecidomyids, saw-flies, cuckoo-flies, ichneumons, braconids and ants.

MISCELLANEOUS NOTES AND DESCRIPTIONS OF NORTH AMERICAN GEOMETRIDÆ.

BY JOHN A. GROSSBECK,
NEW YORK, N. Y.

Petrophora rubrosuffusa, new species.

Expanse, 24–27 mm. Palpi and front deep brown, vertex whitish or reddish, sometimes composed of a combination of these colors. Thorax and abdomen soiled yellowish, the collar and patagia of the former marked with black, all wings soiled whitish suffused with a delicate shade of grayish-brown, and, on the costal area of the primaries with pink most pronounced toward the apex. Intradiscal line of primaries absent or marked on the costa one-fourth out by a white, squarish spot. Median line similarly marked on the costa slightly inward of the middle. Extradiscal line whitish, rather broad, distinct on anterior half of wing, obscure or absent on posterior half; extends from one third in on costa in an even outward curve to M_3 , then, forming an acute angle, runs in an even inward curve to inner margin. Discal spots absent. Beneath, pinkish-ash except on posterior half of primaries where it is soiled whitish tinged with smoky toward the basal portion. Primaries with anterior part of extradiscal line reflected and marked inwardly by a blackish shade. Secondaries with an elongate black discal mark divided by a clear white dot. A brown extradiscal line on the outer fourth of the wing running subparallel to the outer margin may be traced from the inner margin to vein Cu_2 or M_1 and from here on is marked on the veins by more or less distinct dashes.

Types.—Three males from Dr. Barnes, one cotype of which is deposited in the American Museum of Natural History.

Habitat.—White Mts. and Palmerlee, Arizona.

From above this species very closely resembles *Stamnodes delicata*, but besides having pectinated antennæ in the male, the present species is very different in design beneath. Structurally and in maculation it is more nearly related to *Petrophora volucer* and from this species may be distinguished by its somewhat shorter and broader wings and by its deeper coloring.

Petrophora costimacula, new species.

Expanse, 30 mm. Palpi brown, tipped with white; front wholly white, vertex brown. Thorax and abdomen smoky-gray, the former with the collar and disk brown. All wings above smoky-gray, the fringes paler, and a stripe along costa whitish interrupted by two brownish spots near middle and outer two thirds and checkered at the base and apex with short transverse strigæ. Beneath, primaries smoky except at costa where they are yellowish irrorate with brown specks which, two thirds out from base, form a decided brown spot; secondaries concolorous with costal area of primaries and crossed by numerous short brown strigæ which near inner margin at center collect into a large spot. Discal spot large, brown, contrasting.

Type.—One male in the American Museum of Natural History (Grossbeck collection).

Habitat.—San Diego, California.

A species slightly resembling *Stamnodes gibbicostata* and *S. albiapicata*, but generically distinct from both. In *Petrophora* it falls in the same group with *rubrosuffusa* and *volucer*.

DASYCOSYMBIA, new genus.

Palpi moderate in length, slender, ascending, end member minute; tongue well developed; front smooth; antennæ of both sexes simple, in male strongly ciliated below. Thorax and abdomen untufted. Middle tibiae with a single pair of spurs, posterior tibiae of male with a single long spur one third the length of the tibia from the base and with a large dense hair-tuft which with the long hairs of the tarsal joints completely conceals the tarsi, the claws of which are obsolete; posterior tibiae of female normal, with double pair of spurs. Fore wings with 12 veins and two accessory cells, R_1 , from end of apical accessory cell, R_2 , R_3 and R_4 on one stalk. Hind wings with *Sc.* anastomosing with *R* for a short distance just beyond humeral bend, M_2 present.

Type.—*Dasycosymbia gracilata* Gross.

Allied to *Charommatæa* Hulst but differing in the presence of the long spur on the hind tibia of the male and the extremely dense hair-tuft on this same joint which in *Charommatæa* is a comparatively slight fringe.

***Dasycosymbia gracilata*, new species.**

Expanse, 23.5–25 mm. Front, posterior portion of vertex and superior portion of palpi dark carmine-brown; remainder of head pale testaceous. Thorax,

abdomen and ground color of wings pale to dark testaceous, the lighter color prevailing chiefly in the female. Primaries crossed by three equidistant deep testaceous or slightly brownish lines, the first two of which, through a heightening in tint of the ground color, may be partly lost to view. The intradiscal line crosses the wing one third out from the base, is bent in on both margins, and angled inwardly on the cubital vein; it is sometimes slightly diffuse, especially on the costa. The median line, sometimes reduced to a shade, passes through the center outward of the discal spot which is small, rounded and distinctly white. The extradiscal line is markedly denticulate and follows in general the outer margin of the wing; it is usually strongly emphasized on the veins, and rarely the connecting lines are obsolete so that the line is reduced to an irregular row of spots. Terminal line distinct, broken at the veins. Fringes concolorous with ground color. Secondaries like the primaries but with intradiscal line missing and with median line usually obscure, though occasionally quite distinct; the extradiscal line corresponds to, and is exactly like, that of the fore-wings. Beneath, all wings pale testaceous with the costa of primaries and extradiscal lines, particularly the venular spots, brownish.

Described from ten males and four females received from Dr. Barnes, several cotypes of which are deposited in the American Museum of Natural History.

Habitat.—Redington; Christmas, Gila Co.; Baboquivera Mts., Pima Co., August; Santa Catalina Mts., Pinal Co., August 1-7—all in Arizona.

A species quite different from anything I know, with the mottled appearance of *Leptomeris plantaginaria* Hulst and color of *Cosymbia myrtaria* Gn.

Deilinea lenitaria, new species.

Male.—Expense, 32-36 mm. Palpi and front brown, vertex with mixed brown and white scales giving a whitish gray color. Thorax grayish with a reddish or purplish tinge. Abdomen silky yellowish. Ground color of primaries soft purplish-brown more or less irrorate with black atoms; margin testaceous. Intradiscal line one third out, blackish, broad, diffuse, obtusely angled at veins. Extradiscal line two thirds out, concolorous, rather broad, usually defined, bisinuous. A broad, diffuse median shade passes between these two lines which occasionally may join with them, the whole then forming a single broad band bounded by the intra- and extradiscal lines. A more or less developed submarginal line of black spots, the individual spots occasionally marked outwardly by a whitish dash, passes through the middle of the outer space. Discal spot black, moderate in size, conspicuous. In one specimen the cross lines and median shade are almost obsolete and the irrorations over the wing are very profuse. Secondaries pale yellowish becoming faintly purplish toward outer and inner margins; blackish irrorations are present, especially outwardly. An

indication of a cross line is present on the middle of the inner margin which extends a short distance into the wing. Discal spots small or absent. Fringes as in primaries. Beneath, pale yellowish pink with sparse irrorations, the disk of the primaries somewhat smoky.

Female.—The female of this species is quite uniformly pinkish or pinkish-yellow above and below, with the merest suggestion of the cross lines. The discal spot on the primaries and submarginal row of black spots is present, but reduced in size. Dusky irrorations disposed as in the male can be traced on the wings.

Types.—Six males and five females from Mr. Geo. H. Field; two males from Dr. Wm. Barnes. Types and cotypes are in the American Museum of Natural History.

Habitat.—San Diego, California, April 30, May 2, 4, 24, 31, June 16, 24, 25, 27, Aug. 1, 22, 23 and Sept. 9.

Compared with *D. fumosa* this species lacks the deep blackish-brown color and angular submarginal line bordered, especially at the apex, with rusty-brown. From *D. hulstii* it differs in the male by its much deeper and more complete ornamentation and in both sexes by its deeper coloring.

Deilinea verdiaria, new species.

Expanse, 38-42 mm. Palpi and front pale brown; vertex whitish. Thorax and ground color of primaries yellowish with a distinct ferruginous cast, and more or less densely scattered over with deep brown atoms. Intradiscal line one third out, moderately broad, distinct or only vaguely indicated, slightly curved or irregular in its curves. Extradiscal line two thirds out, concolorous, rather narrow, defined or scarcely differentiated from the surrounding ground color. Subterminal line absent or represented by a more or less complete series of intervenular black spots some of which are outwardly bordered by a whitish mark. The inner and median areas are usually darker in color than outer area. Discal spot large, black, distinct. Secondaries whitish, irrorate with black dots outwardly. A cross line through the center, faint or absent on disk of wings, becomes distinct at inner margin. Beneath, yellowish-pink with scattered brownish atoms. Discal spots usually showing. Maculation absent.

Types.—Four males and one female in the American Museum of Natural History (Grossbeck collection).

Habitat.—Verdi, Nevada.

This species has the same type of ornamentation as *fumosa*, *lenitaria* and *hulstii* but is larger than all and in addition has a characteristic ferruginous tinge. In general aspect it is also on account of the dense irrorations a much more mottled species.

Macaria puertata, new species.

Expanse, 16–22 mm. Head, body and wings pale yellowish-gray overlaid with darker grayish-brown scales with an almost imperceptible pinkish cast. Two broad dark brown lines cross the primaries. The first one third out becomes evident in the cell and thence runs obliquely inward in a slight curve. The second less than two thirds out is sinuous, distinct on the costa but becoming very narrow a little below; on vein M_1 a sharp angle is formed and thence it becomes heavier to inner margin. Discal spot a large diffuse spot or ring. Outer area more deeply shaded than inner or median areas, the outer half being more tinged with pinkish and paler than the inner half. Terminal line brown, broken, externally edged with whitish. Secondaries similar to primaries but usually more mottled with the overlaying color. The inner line is indistinct or absent; the outer line usually heavy and more or less sharply angled at middle. Discal spot absent or distinct. Outer area and terminal line as in primaries. Beneath, whitish specked with brown except outer area which is a quite uniform pale brown. Markings of above showing through but much paler. Discal spots large, distinct.

Described from ten males and four females received from Mr. Geo. H. Field. Types in the American Museum of Natural History; cotypes with Mr. Field.

Habitat.—La Puerta Valley, California, July 11, San Diego, California, July 31 and August 1.

Allied to *Macaria infimata* Gn., but with the cross lines much heavier and less angular. In *infimata* these lines are only rarely defined and usually tend to break up into dots while in the present species they are always present and exceptionally broad. A poor specimen clearly attributable to this species is in the Henry Edwards collection from Nebraska. It has not been made a type.

Anthelia nigroseriata Pack. and *A. taylorata* Hulst.

In 1873¹ Packard described *Tephrosia nigroseriata* from two males taken in California by Edwards. The species is well diagnosed and there is no mistaking the particular form the author had before him. In 1876² he describes and figures on Plate IX, Fig. 6o, under the name *Lozogramma nigroseriata* a different much larger insect from Victoria, Vancouver Island (Crotch), and Sanzalito, California, referring in his remarks following the description to the California specimens (those of Edwards' included, presumably) as being smaller and differing so much at first sight as to be taken for another species.

¹ Proc. Bost. Soc. Nat. Hist., Vol. XVI, p. 32.

² Monograph Geometrid Moths, p. 246.

In 1883³ Hulst described *Tephrosia fautaria* from California and in 1896⁴ another species, *Anthelia taylorata*, from specimens taken at Victoria, British Columbia. Incidentally, in this same paper he refers Packard's *nigrosciriata* (which it appears he had misidentified)¹ to the genus *Deilinca* and his own species, *fautaria*, to a new genus erected for its reception, *Thallophaga*. *Anthelia* likewise is created for his species, *taylorata*. Still later in 1900² Hulst described *Tetracis hyperborea* from Virgin Bay, Alaska.

Hence four names are involved which I would apply to two very distinct though congeneric species.

One species expands about 35 mm., the outer row of dots, when present, is evenly rounded to below costa and then straight to inner margin, and occurs, as far as our records show, along the Pacific Coast from Vancouver Island northward to Alaska. The other is smaller, expanding not more than 28 mm., and has the outer row of dots (which latter are usually connected by a narrow shade line) more or less defined, extending in pronounced waves to the inner margin. It has not been recorded outside of California from where (Monterey Co.) I have received a series of no less than thirty specimens.

Dyar¹ has already referred *Thallophaga fautaria*, the smaller form, to *Anthelia nigrosciriata* but the fact that in the same note he refers *Tetracis hyperborea*, of which he has the type, to the same species, which he says Packard figures well, indicates that he regarded Packard's name as applying to the large more northern form. His reference of *fautaria* to this form therefore is an error, for while *fautaria* does equal *nigrosciriata* Pack., Proc. Bost. Soc. Nat. Hist., it does not equal *nigrosciriata* Pack., Monogr. Geom. Moths.

The form described by Packard in the monograph will take the name *Anthelia taylorata* Hulst with *Tetrachis hyperborea* Hulst as a synonym, the genus *Anthelia* of Hulst being well founded.

The synonymy will stand thus:

³ *Entomologica America*, Vol. III, p. 216.

⁴ *Trans. Am. Ent. Soc.*, Vol. XXIII, p. 337.

¹ Dyar, *Proc. Ent. Soc. Wash.*, Vol. VI, p. 225, 1904.

² *Proc. Wash. Acad. Sciences*, Vol. II, p. 496.

Anthelia nigroseriata Pack., Proc. Bost. Soc. Nat. Hist.

= *Thallophaga fautaria* Hulst.

Anthelia taylorata Hulst. = *Lozogramma nigroseriata* Pack.,

Monogr. Geom. Moths = *Tetrachis hyperborea* Hulst.

Tephrosia (*Catopyrrha* in Dyar's Cat.) *ferruginosaria* Pack. (Proc. Bost. Soc. Nat. Hist., XIII, p. 288, 1871, XVI, pl. I, f. 21, 1874) described from one female from California and referred by Packard himself (Monogr. Geom., p. 426) as a variety of *nigroseriata* (note that *ferruginosaria* is described earlier than *nigroseriata*) is a *Deilinia* and if not Guenée's *fæminaria* is at least Hulst's *celataria* which is said to be synonymous with Guenée's species.

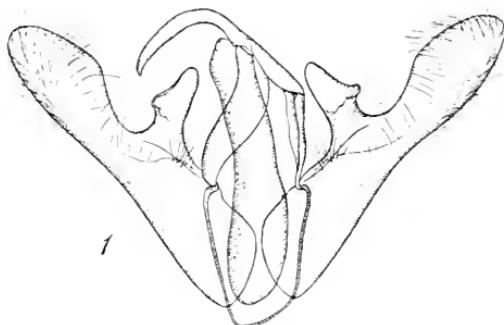
Sericosema angulata Warren (Novitates Zoologicae, XII, 361, 1905) appears to be a typical *Anthelia taylorata*.

Catopyrrha coloraria Fabr. and **C. sphæromacharia** Harv.

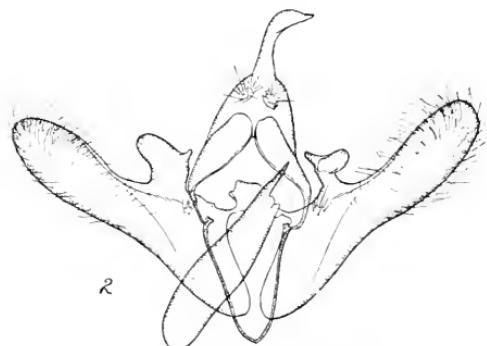
In Dyar's Catalogue of Lepidoptera *Catopyrrha coloraria* Fabr. is listed with four varieties. A revision of these forms shows that two valid species are concerned which are very easily distinguishable from each other. One, *coloraria* typical, varies from pale grayish-brown with a faint pinkish tinge, with darker brown markings (spring form) to clear yellow with roseate markings and fringes (summer form, *dissimilaria* Hubn.). The outer line of the primaries is rather broad, curved, and more or less diffuse. Beneath, the heavy mottling varies from brownish (*coloraria*) to deep red (*dissimilaria*). The other species, *sphæromacharia* Harvey, is also pale grayish with a pinkish admixture and varies to yellow and olivaceous. The outer line of the primaries is straighter, narrower, and more defined and extends more toward the apex of the wing on the costa. Beneath, also, the reddish mottling is reduced in extent and tends to form a distinct and defined cross line. Occasionally, however, the entire outer field is quite uniformly reddish except for patches of ground color below vein Cu₁. In the typical form of this species there are two large black spots in the outer area of the primaries above, one at the center and the other near the inner margin. *Perolivata* described by Hulst as a variety of *coloraria* is referable to this species but the black spots are greatly reduced in size, being practically absent. The variety was based on color which differed much from the type form of *coloraria* but in this respect is identical with

Harvey's species. Since it differs from this however in the absence of the large spots it may well be retained as a variety of it on this character.

Structurally, the two species differ in wing shape, those of *sphæro-*



1. *Catopyrrha coloraria.*



2. *Catopyrrha sphæromacharia.*

macharia being considerably more acute than in *coloraria*, and in the length of the palpi, those of the former being decidedly longer and more slender than those of the latter.

In describing *sphæromacharia* Harvey seems to have noticed the decided difference between this species and *coloraria* but, apparently in deference to Packard's view, describes it as a variety of *coloraria*.

My notes and specimens would indicate that *coloraria* is distributed from London, Canada, southward along the Atlantic seaboard to and including Florida. *Sphæromacharia* seems not to

occur north of Georgia and Arkansas (Carroll Co.) and extends southward to Florida and Texas.

The two species with their synonyms and varieties should stand thus:

Catopyrrha coloraria Fabr. (*forma verna*) = *accessaria*

Hubn. = *cruentaria* Hubn.

Var. **dissimilaria** Hubn. (*forma æstiva*) = *olenusaria* Walk.

Catopyrrha sphæromacharia Harv.

Var. **perolivata** Hulst.

Ferruginosaria Pack. listed with *coloraria* under *Catopyrrha* in Dyar's Catalogue, and *Catopyrrha hulstii* described by Dyar (Proc. Ent. Soc. Wash., VI, 226, 1904) belong to *Deilinca*. *Atropunctaria* Walk. is said by Mr. Prout (Gen. Ins., fasc. 129, p. 250, 1912) to be a synonym of *Pseudoterpna pruinata* Hufn. an European species, the locality given for it, "East Florida," being incorrect.

Selidosema wrightiaria Hulst and **S. inconspicua** Hulst.

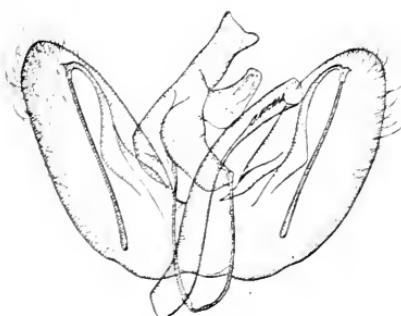
In 1888 (Ent. Am., III, 215) Hulst described *Boarmia wrightiaria* from four males taken at San Bernardino, California, and in 1896 (Trans. Am. Ent. Soc., XXIII, 264), *Chloroclystis inconspicua* from one female¹ also from California. In the Canadian Entomologist (Vol. XL, p. 344, 1908) Pearsall after an examination of the type says this latter "proves to be the female of *Selidosema wrightiaria*." While not contradicting this contention the present writer in 1909 (Can. Ent., XLI, 194) cast a shadow of doubt upon it, and in a discussion of *wrightiaria* limited the name to the type in Hulst's own collection at Rutgers College. Incidentally he also remarked, because the type at New Brunswick did not exactly correspond to the measurement given in the original description, that Hulst may also have had another species (*Clora agrestaria* Gr.) before him, and this proves to be correct, as a male type of *wrightiaria* in the Brooklyn Museum represents *agrestaria*.

Recently I have had an opportunity of examining quite a number of specimens both of *wrightiaria* as limited by me and of the form described as *inconspicua*. Though evidently nearly allied the species

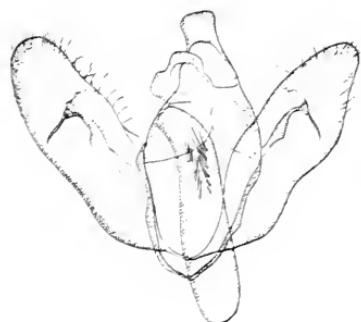
¹ In the generic diagnosis of the genus erected for *inconspicua*, Hulst refers to a male, but in the specific characterization he says he has one female only, and this is borne out by the type specimen which is a female.

are distinct as will be seen by the accompanying figures of the genitalia. Superficially *inconspicua* is smaller than *wrightiaria* and may be otherwise distinguished by the course of the cross lines of the hind wing which in *inconspicua* follow more nearly the outer edge of the wing.

I have, through the kindness of Mr. Field, also a type of Dr. Dyar's *Selidosema aethalodaria* and if the other five types are the



Selidosema inconspicua.



Selidosema wrightiaria.

same as this, and presumably they are, the name is a synonym of *inconspicua*.

Cleora ? glaucaria, new species.

Expanse, 36-38 mm. Palpi and front brown, vertex brown posteriorly, grayish or distinctly white anteriorly. Thorax brown, paler at the collar, abdomen pale yellowish-brown. Ground color of primaries brown and pale bluish-white, the latter color, slightly intermixed with the brown, chiefly occupying the space to the median shade, the outer part of the median area, and the center of the outer area just preceding the subterminal line. Intradiscal line brown, not broad, boldly and evenly outcurved to inner margin; crosses the wing about one third out but extends inward on both costal and inner margins. Median shade broad, quite well defined on inner side, diffuse outwardly; strongly angulated on discal cell, and less so on anal vein. Extradiscal line brown, well defined, scalloped; begins one third in on costa, extends outward to vein M_2 , then inward to inner margin, ending less than one third out on this margin. Subterminal line denticulate, bordered inwardly by the bluish ground color and outwardly by the brown ground color. Terminal line poorly defined, brown. Fringe edged by a brown line. Discal spot not large, distinct. Secondaries pale grayish brown, slightly darker outwardly. A single irregular, rather fine brownish line crosses the wing just exterior to the faint discal spot. Fringes and terminal line as in primaries. Beneath, uniformly yellowish tending to flesh color, no spots or lines reflected.

Types.—Two females from Dr. Barnes, one cotype of which is deposited in the American Museum of Natural History.

Habitat.—Palmerlee and Redington, Arizona.

This species is most nearly related to *Alcis lallata* Hulst and *Cleora lixaria* Grt., but is separable from both by the position and course of the intradiscal line which in the present species is boldly and evenly curved, not strongly angulate both in the discal cell and on the anal vein as it is in both the first mentioned species.

Euemera angularia Gross.

This species described in the Journal N. Y. Ent. Soc., XVI, 27, 1908, is a small *Eriplatymetra grotaria* Pack. The type is in the Academy of Natural Sciences, Philadelphia.

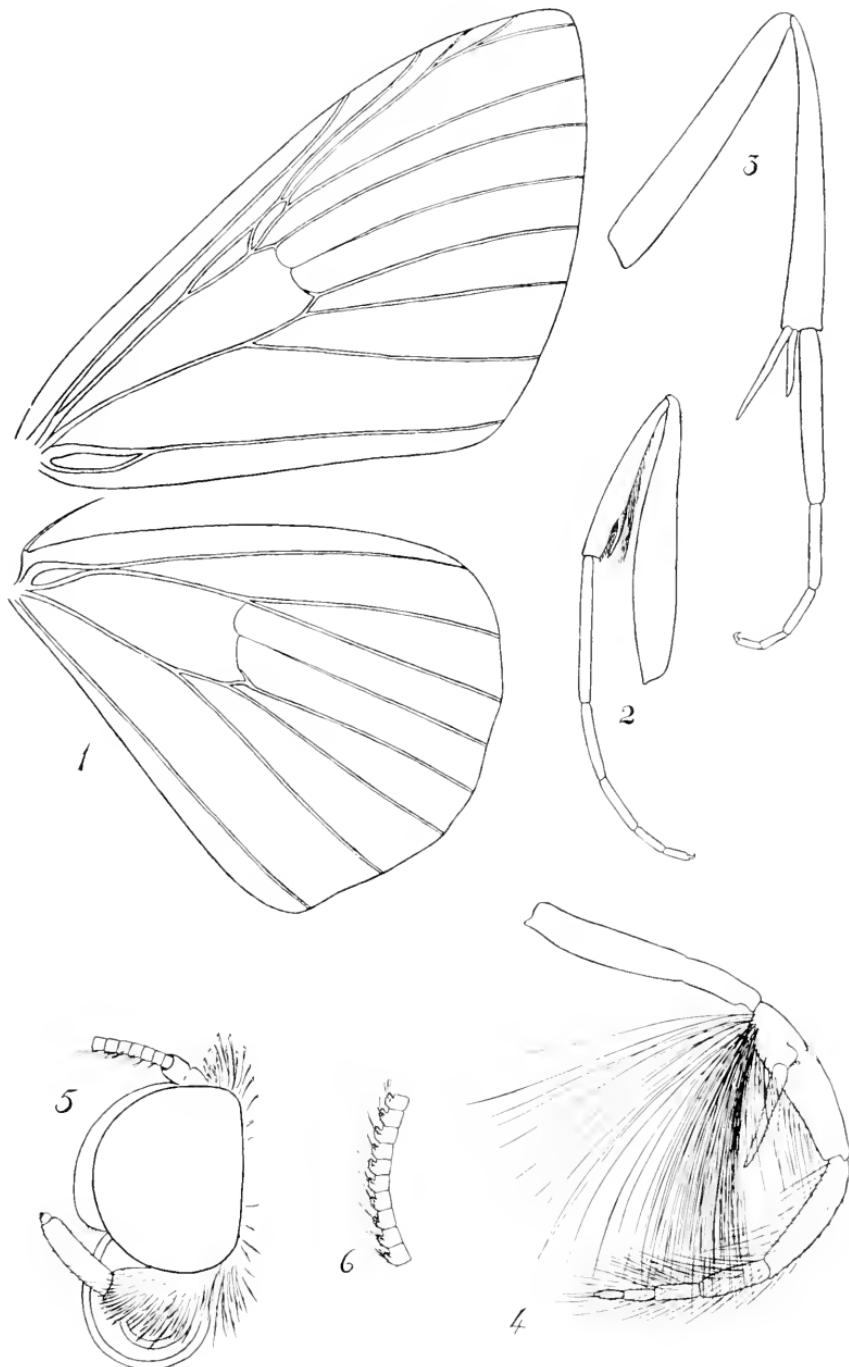
EXPLANATION OF PLATE XVII.

1. Venation of *Dasyosymbia gracilata*.
 2. Fore leg of male.
 3. Mid leg of male.
 4. Hind leg of male.
 5. Head and appendages.
 6. Section of antenna at middle.
-

MISCELLANEOUS NOTES.

Color Pattern in Coleoptera Wings.—On June 26, 1912, while beating scrub pine at West Point, N. Y., I found in my umbrella *Sinorylon basilare* Say. It had unfortunately been struck and injured. Its wings were extended and I noted that these wings were blotched with blackish. The wings of *Myodites fasciatus*, which are never folded, are also marked with patches of pigment, but the above is the only case which has come to my attention of beetle wings, covered by the elytra, having a color pattern.—WIRT ROBINSON.

Fiery Ground Beetle (Calosoma calidum Fabr.).—An examination of museum specimens resulted in finding under the wing covers of one of these beetles, a group of 4 or 5 large, oval puparia, probably those of *Biomyia georgiae* B. & B., a parasite reared from this insect in 1898 by Mr. A. F. Burgess. The occurrence of parasites in the



Dasycosymbia gracilata

adults of the larger Coleoptera is infrequently noted and is therefore of more than ordinary interest to entomologists. The collection of numerous specimens of adult Coleoptera for the special purpose of rearing parasites might result in securing data heretofore almost unsuspected.—E. P. FELT.

Neuroterus saltatorius Hy. Edw.—Specimens of this interesting gall, a globose, unilocular swelling less than 1 mm. in diameter on the under side of white oak leaves, were received under date of July 24, 1912, from Mr. R. M. Taylor, instructor in pathology, Michigan Agricultural College, Ann Arbor Mich. Mr. Taylor calls attention to the snapping or jumping habit of the galls, and careful listening enables one to detect a low snapping or crackling, evidently due to the activity of the insect within the gall, this in spite of the fact that the specimens had been in press a week before being forwarded. Mr. Taylor also states that inhabited galls when laid upon the table jump around more or less as a result of larval activities. The species has been reported from New York State, though Mr. Beutenmuller (Am. Mus. Nat. Hist., 1910, 28: 125) questions the identity of the eastern gall with the one originally described by Edwards.—E. P. FELT.

Two-spotted Ladybeetle (*Adalia bipunctata* Linn.).—This common ladybeetle was unusually abundant last summer, the small, black grubs being so numerous on one Norway maple at Nassau as to make a nuisance of themselves by dropping upon parties beneath. A similar super-abundance was observed in Washington Park, Albany, and also in several localities in the vicinity of New York City. The early part of the season of 1912 was unusually favorable for the development of plant-lice and is probably indirectly responsible for the super-abundance of this small lady-beetle.—E. P. FELT.

A Migration of Red Admiral Butterflies.—The Red Admiral butterfly was quite common in August, 1912, on parts of Staten Island and Long Island. On September 9, Dr. Frank Overton of Patchogue and I started across Moriches Bay for Fire Island. It was soon noticed that *Pyrameis atlanta* butterflies were quite common and all flying in a westerly direction. This was not in the direction of the wind. When about half way to the island I commenced to

count the butterflies and when the shore was reached we had seen ninety-two, every one of which was headed in a westerly direction. On land there were countless numbers of *atalanta* butterflies, especially about the flowers of *Pluchea camphorata*, which was growing over considerable areas. Dr. Overton photographed the butterflies that would rise in clouds as we walked through the *Pluchea*. We did not see over twenty Monarch butterflies, which are so often quite common in the fall.—WM. T. DAVIS.

Pink Katy-dids.—Two pink examples of *Amblycorypha oblongifolia* were found among the golden rods at Erma, Cape May Co., N. J., during August, 1912. A female was collected on August 15 and a male on August 18. Later three females were found at West New Brighton, Staten Island, N. Y., in Mr. Chas. W. Leng's garden and vicinity. In Professor Wheeler's paper on "Pink Insect Mutants," *American Naturalist*, XLI, December, 1907, seventeen females and only three males of the pink form of *Amblycorypha oblongifolia* are recorded, from which it will be seen that the capture of a pink male is of some interest.

As a slight addition to the subject of pink insects, it may be added that the jassid *Gypona octolineata* Say is sometimes partly green and partly pink. Individuals either all pink or light brown have been recorded.—WM. T. DAVIS.

A Hemipteron on Carrion.—During a visit to Yaphank, L. I., May 17–20, 1912, the writer came across a barrel buried level with the soil and partly filled with water, in which floated the dead body of a box tortoise, *Cistudo carolina*. Removing the turtle to land, examination on the next day disclosed, besides various species of carrion beetles, a dozen or more specimens of *Corynocoris typhaeus* Fabr. apparently feeding on the putrid matter between carapace and plastron.

In recording this observation it would be of interest to learn whether other collectors have observed similar habits in this or other species of Hemiptera.—GEO. P. ENGELHARDT.

PROCEEDINGS OF THE NEW YORK ENTOMOLOGICAL SOCIETY.

MEETING OF OCTOBER 17, 1911.

The regular meeting of the New York Entomological Society was held in the American Museum of Natural History, Tuesday evening, October 7, 1911, at 8.15 P. M., with president Leng in the chair and 17 members present.

Minutes of the previous meeting were read and approved. Mr. Schaeffer, the librarian, reported the receipt of the following publications:

- Entomologische Zeitung, 1911, No. 2.
 - Anales Museo Nacional, Buenos Aires, Serie III, Vol. 13.
 - Tijdschrift voor Entomologie, 1911, No. 2.
 - Deutsche Entomologische Zeitschrift, 1911, No. 3.
 - Bull. Soc. Ent. d'Egypte, 1910, No. 3.
 - Verh. K. K. Zoo. Bot. Ges. Wien, 1911, Nos. 1 and 2.
 - 41 Annual Rep. Ent. Soc. Ontario, 1910.
 - Names Applied to Bees of Genus *Nomada*, by T. D. A. Cockerell.
 - Description of New Hymenoptera, 3, by J. C. Crawford.
 - New Tropical Millipedes of the Order Merophaeta, by O. T. Cook.
 - Descriptions of New Species of Wasps, by A. A. Rohwer.
 - Entomologische Beobachten, Vol. III, Nos. 55-60.
 - Annales Soc. Ent. Belgique, Vol. 54.
 - Bulletin Lab. Zool. Gen. Agraria, Vol. V.
 - Wiener Entomologische Zeitung, Vol. XXX, Nos. 4-7.
 - Entomologiske Meddelelser, 1911, April.
 - Bulletin de la Société Impériale des Naturalistes de Moscou, 1910, Nos. 1-3.
 - Annales del Museo Nacional de Montevideo, Vol. VII, No. 4.
 - Bull. Univ. Texas, No. 164.
 - Deutsche Entomologische Nationalbibliothek, Vol. II, Nos. 11-18.
 - Descriptions of 1 New Genus and 3 Species of Ichneumon Flies, by H. L. Viereck.
 - Entomologische Blätter, Vol. VII, Nos. 5-9.
 - Canadian Entomologist, Vol. XLIII, Nos. 7-10.
 - Zeitschrift f. wissenschaftliche Insektenbiologie, Vol. VII, 3-9.
 - Report Ent. Dept. N. J. Agricult. Coll. Exp. Stat., 1910.
 - Studies in Sawfly Genus *Haplocampe*, by S. A. Rohwer.
 - Societas Entomologica, XXVI, Nos. 10, 11, 12, 13.
 - Insektenbörse, Vol. 28, Nos. 19-38.
 - Entomologische Rundschau, Vol. 28, Nos. 13-19.
 - Coleopterorum Catalogus, Nos. 32-35.
 - Memoirs on Coleoptera, II, by Thos. L. Casey.
- Mr. Schaeffer also stated that he had received several copies of Major Casey's Memoirs on Coleoptera to be distributed to those members interested. The secretary read a letter from Dr. Crampton, thanking the society on behalf

of the museum for the Zabriskie Collection, also a letter from Mr. Carl Zeimet, tendering his resignation. On motion Mr. Zeimet's resignation was accepted with regrets.

Mr. Grossbeck, chairman of the field committee, reported that sixteen field meetings had been held during the season, but that in all cases the attendance was not as large as desired; and suggested that the number of meetings be reduced and an effort made to secure a larger attendance.

Mr. Schaeffer quoted from some old reports of field meetings to show that then as now the number participating in the field meetings was small.

Mr. Wm. T. Davis read a paper entitled "Notes on the Distribution of Several Species of 'Tiger-Beetles,'" to be published later, and exhibited specimens of *Cicindela puritana* from Chesapeake Beach, Maryland, *Cicindela rugifrons* of the spotted variety from an old gravel quarry at Hyattsville, Maryland, *Cicindela sexguttata* found associated with *rugifrons* in a pine barren area at Jamesburg, N. J., *Cicindela unipunctata* from Ridgeway, N. J., and a single female specimen of *Tetracha virginica* found Sept. 8 near Central Park, Long Island, N. Y., on an uncultivated part of the natural prairie. These specimens were all collected during 1911.

Mr. Drury stated that he had taken *Tetracha virginica* on a sand bar along the Ohio River, near Cincinnati, under material and rubbish left by campers.

Mr. Engelhardt reported the capture of *Cicindela lepida* at Rockaway. They were found only on the first row of sand dunes.

Mr. Schaeffer commented on several species of insects, including a number of Diptera, which he exhibited, some of the interesting species among those shown were: *Hirmoneura flavipes* Will., *Rhynchocephalus sackenii* Will., *Rhynchocephalus subnitens* Coq., *Systropus* sp., *Midas cleptea*, *Eccritosia amphionoma* Walk., *Erax* sp., and several new species of *Asilus*, all from Huachuca Mts., Arizona, or Beaver Creek Hills, Utah, and the hemipteron *Zelus rubidus* Stoll, from Brownsville, Texas, new to our list.

Mr. Drury spoke briefly of his experience in collecting in the south and of the severe cases of poisoning he had received from poison ivy, and his experience in dealing with it.

The discussion concerning poison ivy and its treatment was participated in by several of the members.

Mr. Dow exhibited a species of *Trogosita* similar to *virescens*, some 40 specimens of which he had received from Arizona. They differed from *virescens* in lacking the sulcation in the dorsal surface of the head and in the pittings of the elytra.

Mr. Mitchell stated that in studying spiders he had found difficulty in preserving shape and color in either alcohol or formaldehyde or glycerine. He had been experimenting in using a tube with a low vacuum and had found that by getting the proper amount of pressure and adding formaldehyde gas he obtained fairly good results.

Two spiders and a caterpillar preserved in this manner were exhibited.

MEETING OF NOVEMBER 7, 1911.

A regular meeting of the New York Entomological Society was held in the American Museum of Natural History, November 7, at 8.15 P. M. In the absence of the president, the chair was occupied by the vice-president, Dr. Osburn, with 9 members and 6 visitors present.

Minutes of previous meeting read and approved.

Mr. Pollard extended an invitation to the members to attend Dr. Crampston's lectures to be given at the Brooklyn Institute.

Dr. Southwick spoke of the recent death of Dr. Henry McCook.

Under scientific discussion Mr. Grossbeck spoke of his trip with Mr. Dow to Jamaica. Kingston was reached on the 21st of February and the first few days were spent collecting in the vicinity of this place. Port Royal proved an excellent locality not only for insects but for other invertebrates. Later, Cinchona, situated in the Blue Mountains at an elevation of nearly 6,000 ft., was visited. At this altitude few insects were on the wing but many specimens were taken by beating and sweeping, but particularly in old wood. An interesting feature in the ascent was the change in the vegetation from a purely tropical one of palms, bananas, cacti and the like to a temperate one consisting of white clover, wild carrot, strawberry, pine trees, etc. A tree-fern forest on one of the highest peaks of the mountain also produced some interesting forms. Over two weeks were spent at Montego Bay and vicinity in the western part of the island. In general, collecting was not of the best. While at Cinchona it rained every day. In the lowlands it was extremely dry, being at the height of the dry season. However, about 3,000 insects and 1,000 other invertebrates were taken. Among the interesting material taken were some termite tree nests.

Dr. Osburn asked concerning the material of which the nest was made and whether the galleries were impervious to rain.

Mr. Grossbeck stated that the nests were very hard, save for the external covering, which was very brittle. He believed the galleries would not be destroyed by rain.

Mr. Dow said that the butterfly *Papilio homerus* was spreading on the island as was also its food plant, a species of *Hibiscus*. One collector had obtained a number of larvae in April. Concerning the plants Mr. Dow stated that some species such as chickweed, carrot, parsnip and strawberry, if not the same as our species very closely resemble them and that one of the commonest orchids was also common in China. As there was an experimental garden on the island it was possible that certain foreign species of plants had escaped from it.

MEETING OF NOVEMBER 21, 1911.

The regular meeting of the New York Entomological Society was held in the American Museum of Natural History, November 21, at 8.30 P. M., with president Leng in the chair and 19 members and 2 visitors present.

Minutes of the previous meeting read and approved. Mr. Schaeffer, the librarian, reported the receipt of the following publications:

Verhandlungen d. k. k. zool. bot., Gesellschaft in Wien, Vol. LXI, Nos. 5 and 6.

Wiener Entomol. Zeitung, Vol. XXX, No. 8.

The Canadian Entomologist, Vol. XLIII, No. 11.

Bull. de la Société Entomol. d'Egypte, 1910, No. 4.

Entomologische Blätter, Vol. VII, Nos. 10 and 11.

Zeitschrift f. wiss. Insektenbiologie, Vol. VII, No. 9.

Deutsche Entomol. Nationalbibliothek, Vol. 2, No. 2.

Mittheilungen Zool. Mus. Berlin, Vol. V, No. 3.

He stated that he had been arranging the publications of the society, grouping the various kinds together so as to be more accessible to the members.

Under scientific discussion Mr. Leng read an article on "Collecting Beetles in Georgia." In July, 1910, he made his second trip in company with Mr. Davis to northern Georgia and spent two weeks mostly in the vicinity of Clayton and including a four days' trip to Ransom's Mill. The altitude was about 2,000 feet with the mountain ridges extending 3,700 feet. The season was a good one and some 600 species of Coleoptera were taken, but owing to the fact that it was later in the year than when the first trip was made about 250 species were different from those taken the first time.

Among the interesting forms taken were *Amphicoma* sp., *Cychrus andrewsii*, *C. bicarinatus*, *C. canadensis*, *C. violaceus* (1 specimen), *Carabus limbatus* and other large Carabidae in traps, *Carabus limbatus* being uniformly smaller than those taken in the north, *Pterostichus acutus*, *Serica* n. var., *Agrilus fuscipennis*, *Lactica iris* and *Lema solani*.

Mr. Shoemaker exhibited some Arizona beetles collected by his brother while in the Indian service. They were from the arid regions of Arizona and there were some fifty species shown, including several Tenebrionidae. Photographs of the regions were also shown.

Mr. Leng, who in company with Dr. Lutz and Mr. Davis, had just returned from a collecting trip to Florida, commented briefly upon the trip.

They had gone to Florida, November 1, going to Jacksonville first. Mr. Leng and Mr. Davis remained here three days. Dr. Lutz went on down the east coast. Around Lakeland they found a varied country with sand hills, and many lakes with steep sides. A number of species of trees were noted, such as oaks, pines and magnolias, and here they had fair success in light collecting.

At Punta Gorda many kinds of oaks were noted and beyond this toward the gulf shore the country was found to be very level, with pine trees for many miles. Good sweeping was done in low places and sifting in debris on the beach. Somewhat back from the shore a mixture of mangroves and other trees were found and some good species were obtained here by beating.

Dr. Lutz showed some illustrated postal cards of many of the places and spoke briefly of Fort Myers and the other places he had visited.

Mr. Leng said that on trees peculiar to Florida, peculiar insects were found but under the same conditions as existed in the north similar insects occurred. Further, that of the species taken at Clayton, 5 per cent were different from

those found around New York and half the species taken in Florida were different from those around New York and they would be equally so to a Georgia collector, unless from southern Georgia. One should not look under ordinary conditions if they were seeking peculiar species but under peculiar sub-tropical conditions.

Mr. Rolfs, of the Florida Experiment Station, had pointed out that the scattered distribution of tropical plants occurred in restricted areas. One would have to collect in many places to obtain the different desirable species.

Mr. Davis spoke of light collecting at Punta Gorda. Two species of Conocephalids were taken on Palmetto. They were very much alike but there was a distinct difference in their song and one was more difficult to capture than the other.

MEETING OF DECEMBER 5, 1911.

A regular meeting of the New York Entomological Society was held in the American Museum of Natural History, December 5, at 8.30 P. M., with president Leng in the chair and 18 members present.

Minutes of previous meeting read and approved.

Dr. Osburn, chairman of the photograph committee, reported receipt of Mr. Pollard's photograph.

Under scientific discussion Mr. Davis gave some interesting notes on Georgia insects and exhibited a box of the species discussed.

Mr. Schaeffer spoke on the "Genera of the Coleopterous Family Temnochilidae." He said there had been much changing of names in the Coleoptera, especially in Europe, and the name Temnochilidae was generally used now for the old family Trogositidae. Several classifications for the family had been suggested. LeConte and Horn had recognized two tribes only while Reitter had divided the family into four tribes.

Mr. Schaeffer discussed the characteristics of the various genera and told something of their habits. A box of the North American species representing the genera of this family was exhibited.

Mr. Grossbeck spoke of a beetle hunting wasp which he had observed at Yaphank, L. I. The species belonged to the genus *Cerceris* and had made burrows $\frac{3}{4}$ inch in diameter and $4\frac{1}{2}$ -6 inches deep, extending at an angle to the surface. In many cases a Buprestid beetle, which had been collected by one of the bees, was found near the entrance of the burrow. Specimens of the insects and collected beetles as well as a photograph of the burrows taken by Mr. Davis were shown.

Dr. Osburn spoke on the "North American Species of *Brachypalpus*." About 15 species were recognized of this Syrphid genus which was described in 1834. Of these the following had been found in North America:

Brachypalpus frontosus Loew., occurring as far south as Georgia and the best known although not common.

B. rileyi Will., recorded from North Carolina, Ohio and New Jersey.

B. parvus Will., recorded from California, and specimens shown taken in British Columbia. The above species lack the brilliant colored band on the abdomen which are found in the following two:

B. fulcher Will., recorded from Washington and Oregon and taken by Dr. Osburn in British Columbia.

This species hibernates in the adult stage.

B. sorosis Will., recorded from Georgia and New Jersey and specimens received from Idaho.

These species were shown together with a new species which Dr. Osburn had taken in British Columbia.

Mr. Schaeffer reported the capture of *Proctacantha nigriventris* Macq. at Lakehurst, N. J., and *Trechus chalybeus* Mann. at Bellport, L. I., the latter taken by Mr. A. Niclaiy.

Dr. Felt spoke on the habits and characters of *Miastor* and *Oligarces* and showed some living *Miastor* larvæ, several microscopic slides and photomicrographs.

The eggs produced by these flies were comparatively very large.

In the case of *Miastor* the larvæ occurred in large numbers. Near Lake Placid a strip of bark 6 inches long and 3 inches wide had been removed and from one thousand to two thousand specimens found.

They had been noted under decaying bark of beech, birch and chestnut. From five thousand to ten thousand flies had been reared in the laboratory. *Oligarces* larvæ had been found under the thick bark of elm, but had not been noted in masses.

Larvæ of both these genera had certain enemies. In the case of the *Miastor*, larger dipterous larvæ had been found among the masses apparently feeding on them.

MEETING OF JANUARY 2, 1912.

The annual meeting of the New York Entomological Society was held in the American Museum of Natural History, January 2, at 8.15 P. M., with president Leng in the chair and 19 members present.

Minutes of December 5 and December 19 read and approved.

Dr. Lutz, curator, reported briefly on the collections, mentioning especially the acquisition of the Zabriskie and Seiffert collection.

Mr. Schaeffer reported that all the regular exchanges had been continued through the preceding year.

Brief reports were also received from the field committee, publication committee and delegate to the New York Academy. Mr. G. W. J. Angell, of the nominating committee, presented the following report:

President: Raymond C. Osburn.

Vice-President: Chas. L. Pollard.

Secretary: Chas. W. Leng.

Treasurer: Wm. T. Davis.

Librarian: John A. Grossbeck.

Curator: F. E. Lutz.

Executive Committee: G. W. J. Angell, C. W. Leng, E. G. Love, Chas. E. Sleight, H. G. Barber.

Publication Committee: F. E. Lutz, Chas. Schaeffer, R. C. Osburn, W. M. Wheeler.

Auditing Committee: C. F. Groth, Edward D. Harris, E. L. Dickerson.

Field Committee: Geo. P. Engelhardt, John A. Grossbeck.

Delegate to New York Academy of Science: E. B. Southwick.

On motion the secretary cast the ballot for the nominations presented.

Moved and carried that a vote of thanks be extended to the retiring president, Mr. Leng.

Under miscellaneous business Mr. Barber requested that the members present more short notes for publication.

Mr. Comstock reported the capture of *Erebus odora* at Hoboken.

Moved by Mr. Dow that a committee of two be appointed to confer with a similar committee from the Brooklyn Entomological Society to arrange for the annual dinner. The president appointed Mr. Engelhardt and Dr. Lutz.

Mr. Harvey Voss, of Paterson, was proposed for membership by Mr. Grossbeck and on motion elected as member.

Mr. Leng, the retiring president, presented an interesting paper on the "Geographical Distribution of the Cicindelidae of the Eastern United States."

Mr. Pollard gave some notes on the psychology of the "Baldfaced Hornet." While camping in the Ramapo Mts., near Bear Swamp, last July, in company with Mr. Sleight, Mr. Pollard said he had an opportunity to observe *Vespa maculata* capturing insects, and to experiment with it. The wasps were first noticed capturing some collected noctuids which were lying on the table. This insect would circle around the table and then dart directly down at a moth. In some cases at least their vision was poor, as flies quite near them would not be captured, while the wasps could be misled by dark spots of bits of mud substituted for the insects.

Other insects were tried and when found too heavy, the wasps would take part at a time (as in the case of the butterfly *Argynnis aphrodite*), first the wings and then the body.

When pinned insects were tried on the wasps they would in like manner take first one part and then another, cutting off the body close to the pin.

A Lycosid spider and a hornet were placed together. They attacked each other and the following morning the hornet was found to be dead. When a hornet and bumble bee were placed together, however, no results were obtained.

Mr. Davis stated that Mr. Sleight and he had made similar observations. They had observed *Vespa maculata* dart at flies on the side of a tent but at other times go very close to the flies without capturing them. He had also observed them feeding on other *Vespa*.

Dr. Lutz moved that a vote of thanks be extended to Mr. Schaeffer for his services as librarian.

Dr. Osburn stated that only a single species of crayfish—*Cambarus bartoni*—had been noted heretofore from this locality, but recently in examining some specimens collected for the aquarium from Prospect Park and Central Park lakes it was noted that there was a different species, *Cambarus limosus*, and this was found to be abundant.

Ortmann in his paper on the crayfish states that it occurs in the Delaware,

Potomac and other drainage systems. It would be interesting to know how it became established here and Dr. Osburn urged that the members look for it in other localities.

MINUTES OF MAY 21, 1912.

A regular meeting of the New York Entomological Society was held May 21, 1912, in the American Museum of Natural History, at 8.15 P. M., president Dr. Raymond C. Osburn in the chair and 23 members present.

The librarian reported that the arrangement of back volumes of JOURNAL is completed, the arrangement of separates nearly completed and catalogue of Society's books well in hand. He stated that 97 complete sets, Volumes I to XIX, were on hand.

The librarian also reported the books received during March, April and May as follows:

By Exchange.

- Insectenbörse, Nos. 6, 8, 9, 15, 16, 17, 18, 1912.
Entomologische Rundschau, Nos. 3, 4, 1912.
Bull. de la Société Entomologique d'Egypte, 1 fasc., 1911.
Canadian Entomologist, No. 3, 1912.
Entomologische Mitteilungen, Nos. 3, 4, 5, 1912.
Entomologische Zeitschrift, Nos. 1, 2, 3, 4, 5, 1912.
Entomologische Blätter, Nos. 3, 4, 5, 1912.
Wiener Entomologische Zeitung, No. 2, 1912.
Mitteilungen der Schweizerischen Entomologischen Gesellschaft, No. 3, 1912.
The Sarawak Museum Journal, No. 1, 1911.
Mitteilungen aus dem Naturhistorischen Museum in Hamburg, No. 2, 1910.
Annales de la Société Entomologique de Belgique, 1911.
Jahresbericht des Westfälischen Provinzial-Vereins für Wissenschaft und Kunst, 1911.
Entomologische Monatsblätter, Vols. I and II.
Beschreibung neuer Nitiduliden (Reitter).
Systematische Einteilung der Trogositidae (Reitter).
Verzeichniss der von Herrn H. Leder in Russisch-Georgien gessammelten coprophagen Lamellicornier (Harold).
Die Europäischen Nitidularien (Reitter).
Revision der Europäischen Cryptophagiden (Reitter).
Monograph der Eurychoriden (Haag).
Revision der Meligethes-Arten (Reitter).
Die Otiorhynchiden (Seidlitz).
Wiener Entomologische Monatsschrift, Vols. I, II, V, VII and VIII.
Deutsche Entomologische Zeitung, pt. 4, 1911, pt. 1, 1912.
Berliner Entomologische Zeitung, pts. 3 and 4, 1911.

By Gift.

- Monthly Bulletin State Commission of Horticulture (Sacramento, Calif.),
Nos. 1, 2, 3, 1911 and 1912.

Descriptions of New Hymenoptera (Crawford).

Descriptions of New Species and Genera of Lepidoptera chiefly from Mexico (Dyar).

A New Species of *Celithemis* (Williamson).

By Purchase.

Coleopterorum Catalogus: Cerambycidæ, Cerambycinæ. Staphylinidæ III. Ptinidæ.

Mr. Angell gave notice of his intention to move to amend the by-laws by striking out of Article IX the words "he shall publish in each JOURNAL a list of additions obtained during the previous quarter."

Dr. Osburn read a "Review of Walker's Monograph of North American *Æshnas*" and exhibited his own and Mr. Davis's collection of these dragon flies. He said that this volume, devoted to a most thorough study of 14 species and 6 varieties, was a grand piece of work, in which the material in the museums of Canada, United States and foreign countries as well as in private collections was reviewed, and the species were described from every point of view. The larval forms, the season and length of imaginal life, the habitat, influence of weather, enemies, food, eggs, hatching, habits, etc., were all exhaustively treated. The data for migration few, one in America, one in Europe; the data for seasonal variation in number, for the eight stages of nymphal growth, for the length of nymphal life, placed at three years, for symbiosis, are all equally complete. There is a phylogenetic tree of genera, keys for determining males, females and nymphs and 130 pages devoted to complete descriptions and citations, 11 pages of bibliography, 28 plates, of which 6 are colored. Dr. Osburn added that five new species had been described in a preliminary paper and the nymphs of 4 species remained unknown; also that *verticalis* is not a common species as had been supposed.

The collection exhibited by Dr. Osburn was identified by Walker and in Mr. Davis's collection of 9 species there were three not included in Dr. Osburn's personal collection.

Mr. Engelhardt asked if specimens found in March had probably emerged so early in the season. Dr. Osburn said they had and that the species seen flying was probably *Anax junius*. Mr. Leng asked about the distribution, which Dr. Osburn said was palæarctic.

Mr. Schaeffer remarked that there were none in the arid southwestern regions, though some occurred in the mountains.

Mr. Engelhardt spoke of the hemipteron *Corynocoris typhaeus* as an occasional carrion feeder.

Mr. Pollard reported having found, while with Mr. Bischoff at Ramsey, N. J., a *Calligrapha* similar to *C. amelia* Knab abundant on alder and commented on the remarkable difference in the sexes.

Mr. Hall presented *Arctia figurata* found at Runyon, N. J., May 19, to the local collection.

Mr. Shoemaker presented *Onthophagus nuchicornis* and *Sphaeridium bipustulatum*, found near East New York on May 4 and May 20.

Dr. Lutz then opened the Symposium on the Insects of Florida by stating the problems that were presented, *i. e.*, the relations between its insects and those of more northern regions and of Cuba, between the insects of its own northern and southern halves and the bearing of the causes that have been suggested to explain the relation, the frost line for instance, the possibility of a common relation with Central America, giving the opposed views of various authors. He referred also to the differences in Florida itself caused by varied environments and to the unexpected distribution of some Florida creatures with the explanations thereof suggested by Scharff, including former land bridges. He closed without expressing any personal opinion, but by asking what effect, if any, on color and structure could be traced to the Florida climate.

Mr. Davis, speaking briefly, favored accident rather than supposed land bridges as an explanation of the distribution of many species.

Dr. Osburn instanced the lung fishes as another case of remnant survival in three widely separated regions.

Mr. Schaeffer also favored accident as a satisfactory explanation for most of the Coleoptera common to Florida and West Indies, mainly Carabidae and wood-boring species carried ashore by accident.

Mr. Leng, speaking of the Coleoptera, said that much work needed to be done on Floridian and West Indian species before comparisons could effectively be made, but that as far as the facts were known the beetles of northern Florida were largely slightly modified forms of the species occurring northward, but with a not inconsiderable element peculiar to the state. In southern Florida, where a more or less patchy subtropical vegetation is established, less than 10 per cent. of the species are common to Florida and the West Indies. The beetles caught by Mr. Davis in November were used to illustrate these remarks. Mr. Grossbeck, speaking of the Lepidoptera said that among the strong flying Sphingidae, many species were common to Florida and the West Indies, but otherwise the relation was strong between the Floridian and northern faunas. As to the total number of species Mr. Grossbeck said that while the existing information might be regarded as practically complete for macro-lepidoptera, large additions could be expected in mieros.

Mr. Barber read a carefully prepared paper on the Hemiptera, which will later be published in full. He said the species now recorded number 311 against 405 for New Jersey and 345 for Colorado. Omitting the 46 species of the Capsidae, the remaining 275 divided into 7 groups:

1. 32 indigenous to Florida.
 2. 23 common to Florida and West Indies.
 3. 54 common to Florida, Mexico and Central America.
 4. 48 common to Florida, Gulf States, Mexico and Central America. .
 5. 38 common to Florida and Southern States.
 6. 55 common to Florida and United States, of which 19 are widely distributed.
 7. 6 cosmopolitan species.
- Mr. Barber mapped on the blackboard the distribution of the Chinch Bug

as given by Webster, following the Mississippi Valley northward, and again following the shores of the Gulf of Mexico eastward and then proceeding north by the Atlantic Coastal Plain.

In closing, Mr. Barber pointed out that the species common to Florida and West Indies are mainly confined to the southern half of the state and strongly favored the theory of their introduction by prevailing winds. Mr. Comstock, speaking of Lycenidae said that out of 20 species, one was peculiar to Florida, eight common to Florida and West Indies, eight common to Gulf States and Florida, six common to Atlantic States and Florida, but that difficulties of nomenclature made the comparison somewhat uncertain.

Mr. Sherman said that among the Dytiscidae 1 or 2 species might be peculiar to Florida but the great bulk were species distributed generally over the Southern States.

Mr. Davis, speaking of the Orthoptera, said the number already known, 172, exceeded by 19 the records for New Jersey, and would probably reach 225 when complete. Some of these are peculiar to Florida, but the distribution is too imperfectly known to venture any comparison. Mr. Davis referred to the strong mandibular development of the species *Belocephalus* eating the tough palmetto leaves, and said he could personally bear witness to their ability to also take a nip out of the incautious collector. He also exhibited leaves of turkey-oak (*Quercus catesbeii*) brought home last November and containing larvæ which mined the leaves, and by swishing their body rapidly produced a sound by which their presence was detected, and two specimens of the buprestid beetle *Brachys ovata* which had since emerged. Mr. Davis, being directly questioned, declined to make any comparison between the insects of northern and southern Florida until the collections recently made by himself and Mr. Grossbeck were worked up, but pointed out that as the belt of subtropical vegetation observed at Punta Gorda became broader southward, an increase in such subtropical forms as the little green cricket *Cyrtotrixiphia* might reasonably be expected.

There then followed a general discussion of the topic.

Mr. Grossbeck mentioned the broad mangrove growth, the dagger palms, the Spanish bayonets, etc., in parts of southern Florida, but the remarkable sameness of the Lepidoptera and Cerambycidae with northern Florida forms.

Mr. Leng spoke of the currents in the Gulf of Mexico being unfavorable to distribution by drift from Yucatan via Cuba to Florida.

Mr. Franek referred to the erratic distribution of some species of Lepidoptera and both he and Mr. Grossbeck discussed the difficulty in comparison introduced by equally erratic nomenclature.

Mr. Schaeffer said that apparent difficulties in erratic distribution sometimes disappeared after more thorough collecting. Many insects are short-lived and insistent upon certain environment, and unless all conditions are fulfilled may easily be missed even by conscientious carefully trained collectors. He gave an instance in a Mexican species of *Onthophagus* recently found at Prescott, Ariz., though he and other collectors had failed to find it in the Huachuca Mts. and other places much nearer the border.

Mr. Comstock said that among the West Indian Islands there were cases of each locality having a named local race, though in fact all were one species.

Dr. Osburn referred to his own experiences on the Tortugas when during severe storms it was usual to find Cuban species blown across the intervening 90 miles of water. Dragon flies for instance would be found though there was no standing water in which they could possibly have bred. Similarly in our Western States, much accidental distribution is undoubtedly effected by cyclones.

Mr. Schaeffer said it was doubtful if such accidents could be considered in the case of Coleoptera, which are usually not sufficiently strong fliers.

Mr. Davis referred to the accidents by which certain shells have been recently remarkably distributed on the Atlantic coast, and suggested that in the fullness of geologic time such accidents might account for much apparently erratic distribution.

Dr. Lutz and Dr. Osburn pointed out that in the case of alligators and lung fishes, the evidence of fossils made refuge in accident unnecessary.

Dr. Osburn also instanced the remarkable distribution of the dragonfly, *Argia vivida*, common in New Mexico and Old Mexico and occurring again in a very limited way at certain hot springs in Montana and Alberta. It does not fly readily, but hides in the reeds. If not formerly more widely distributed it is difficult to account for its persistence about these hot springs.

Dr. Lutz asked if it might possibly be a case of polyphyletic origin, but Dr. Osburn thought not.

Mr. Wintersteiner stated that Dr. Sharp in his revision of the species included in the genus *Tropisternus* found it impossible to separate our *limbalis* Lec. specifically from *dorsalis* Brullé, occurring in North and South America; the latter name should therefore be used. Also that our *nimbatus* Say is to be regarded as a synonym of *lateralis* Fab.

Mr. Wintersteiner also spoke of one of the specimens collected by Mr. Davis in Florida as probably representing an undescribed species, allied to *striolatus*, in which the upper surface of the hind tibiae is destitute of ciliae or swimming hairs.

INDEX TO NAMES OF INSECTS AND PLANTS IN VOLUME XX.

Generic names begin with a capital, specific names with a small letter. New genera, subgenera, species, subspecies, varieties and *nomina nova* are printed in italics.

- Acanthocinus, 119
 nodosus, 121
 obsoletus, 121
Acantholoma denticulata, 138
Acontia aprica, 140
Actinotia ramosula, 222
Adalia bipunctata, 57, 293
Adelphomyia senilis, 37
Ætia, 56
Æshna verticalis, 303
Agrilus fuscipennis, 298
Alabama argillacea, 57
Alaus myops, 221
Albuna pyramidalis, 200
Alcis lallata, 292
Aleodorus, 20, 22, 25
 bilobatus, 22, 25
 canadensis, 25
 floridanus, 26
 granulosus, 25
 illistris, 25
 intricatus, 25
 nigrescens, 25
 novellus, 26
 partitus, 25
 scutellaris, 25
 turbatus, 25
Aletia, 52, 55
 argillacea, 204
Almodes tenaria, 196
Alsophila pometaria, 196
Alypia octomaculata, 57
Amalopis inconstans, 40
Amblychila, 2, 10
Amaurobius, 144
Amaurochrous cinctipes, 49
 dubius, 50
Amnestes pusillus, 50
 spinifrons, 50
Amficetus, 131
Amficoma, 298
Anagrus, 40
Anaphes, 40, 43
Anaphoidea, 40
Anaulacaspis, 21, 24, 27
 hudsonica, 27
 levigata, 24
 longipes, 24, 27
 nigra, 24
 perexilis, 27
 thoracica, 24
Anax junius, 303
Andricus quercus-californicus, 275,
 276, 285
Aneurota, 21, 25
Aniaria, 2
Anisadactylus lodingi, 203
Anopheles, 144
 claviger, 144
 quadrimaculatus, 143
Anosia plexippus, 202
Anthelia nigroseriata, 286, 287
 taylorata, 286, 287, 288
Anthophilax malachiticus, 212
 hoffmanni, 213
Anthrenus fasciatus, 203
Apateticus bracteatus, 56
 cynicus, 56
Apemea nictitans, 207
Aphidoletes, 147, 246
Aphis malifoliae, 246
Apocheima rachelæ, 219
Arawana, 68
Arctia figurata, 303
Argia vivida, 142, 306
Argynnис aphrodite, 218, 301
 atlantis, 218
 cybele, 218
Armetris nitocris, 196
Artace punctistriga, 216

- Artemisia californica*, 147
Asclepias pulchra, 56
Asilus, 296
Asparagus, 53, 54
Asphondylia diplaci, 151
 cuceliae, 152
 ilicoides, 152
 sambuci, 152
Aster linariifolius, 19
Asteromyia grindeliae, 149
 modesta, 150
Asynapta americana, 103
Attacus promethea, 57
Aulonium ferrugineum, 120
- Banasa calva*, 55
 dimidiata, 55
 sordida, 138
Baptisia tinctoria, 19
Batrisodes globosus, 221
Bellamira scalaris, 140
Belocephalus, 122, 123, 124, 305
 hebardi, 123, 124
 rechni, 124, 125
 sabalis, 123, 124
 subapterus, 122, 124
Berosus, 200
Betula populiflora, 218
Biomyia georgiae, 202
Boarmia wrightiaria, 290
Bocydiini, 67
Bolitophila cinerea, 247
Bombus, 214
Borporopora, 20, 21, 25
 grandis, 25
 quadriiceps, 25
 sulcifrons, 25
Brachyacantha, 200
 bistripustulata, 208
Brachypalpus, 299
 frontosus, 299
 parvus, 300
 pulcher, 300
 rileyi, 299
 sorosis, 300
Brachypremna, 225
 brevirentris, 228, 230, 231, 236
 candida, 226, 227, 228, 233
 dispellens, 226, 227, 228, 230, 236
 eocenica, 225
 pictipes, 225, 228, 233, 234
 similis, 228, 232, 236
 unicolor, 226, 227, 228, 235, 236
 williamsoni, 228, 231, 232, 236
Brachys, 193
 ovata, 193, 305
Brenthis montinus, 217

- Brephos*, 196
 californicus, 196
 fletcheri, 196
 infans, 196, 218, 219
 melanis, 196
 notha, 196
Brochymena arborea, 50
 quadripustulata, 50
Bruchus nigrinus, 221
Brychius, 157, 161, 193
 hornii, 161
Buprestis lineata, 135
- Cacoplia pullata*, 140
Cenia virida, 100
Caliroa cerasi, 125
Callida viridipennis, 140
Callidium antennatum, 221
Calligrapha amelia, 140, 141, 303
Callirhytis guadeloupensis, 278
 lasia, 278
 quercus-agrifoliae, 276
 quercus-pomiformis, 275
Calosoma, 206
 aeneescens, 206
 calidum, 292
 sycophanta, 205
 tepidum, 206
Calymnia orina, 142
Camponotus, 31
 bedoti, 48
 chloroticus, 47
 fullawayi, 47, 48
 mackayensis, 48
 motschulskii, 48
 nearcticus, 121
 ominoosus, 48
 reticulatus, 44, 48
 weissmanni, 48
 yerburyi, 48
Camptomyia, 102
 festiva, 104
Campylenchia curvata, 66
Campylomyia flavoscutata, 102
 gracilis, 102
 modesta, 102
Campylomyza truncata, 102
Canna, 70
Cara, 179, 182, 183, 186, 190, 192
Carabus agassizii, 203, 223
 baccivorus, 223
 canadensis, 223
 cancellatus, 203
 chamissonis, 218
 gladiator, 223
 grønlandicus, 218
 limbatus, 141, 205, 298

- Carabus oregonensis*, 223
sylvosus, 205
tædatus, 223
Cardiola, 20, 21, 25
obscura, 25
Carduus, 53
Carices, 53
Carya, 55
Catopyrrha accessaria, 290
coloraria, 214, 288, 289, 290
dissimilaria, 288
perolivata, 288
sphæromacharia, 288, 289
Catocala herodias, 205
Catocha, 236
Catorama, 121
Ceanothus, 52, 55, 56
Cecidomyia brachypteroides, 149
ocellaris, 238, 248
pinirigidae, 149
Cephaloscymnus occidentalis, 131
Ceraleptus americanus, 134
Ceratinoptera lutea, 121
Cerceris, 299
fumipennis, 135
Cercyonis alope, 218
nephela, 218
Chætolyga militaris, 109
Chalcolepidius viridipilis, 140
Chalcoiphora virginiensis, 120
Charommatæa, 283
Chianobas, 217
Chilosia, 139
Chiloxia, 2
Chitalia, 22, 25
crenata, 22
Chlorochroa juniperina, 51
persimilis, 51
saucia, 51
senilis, 51
Chloroclystis inconspicua, 290
Chlorippe celtis, 141
Chrysobothris, 119
dentipes, 120
floricola, 120, 135
Chrysops cnejus, 35
Cicada, 61
lyricen, 214
septendecim, 202
similaris, 214
Cicindela, 2, 5, 11, 208, 209
abdominalis, 115
ancocisconensis, 9, 10, 14
apicalis, 16
blanda, 16
carolinæ, 15
consentanea, 6, 14
Cicindela cuprascens, 16
dorsalis, 4, 5, 6, 15
duodecimguttata, 4, 6, 10, 11, 11
formosa, 5
generosa, 5, 10, 14, 212
gratiosa, 15
hamata, 15
harrisii, 4
hentzii, 7
hirticollis, 6, 10, 13, 18, 212
hirtilabris, 15
horiconensis, 4, 15
laurentii, 11
lecontei, 15
levida, 6, 9, 10, 14, 296
limbalis, 7, 12, 137
longilabris, 2, 4, 8, 10, 11, 12, 206
macra, 16, 18
manitoba, 5
marginata, 2, 16, 18, 212
marginipennis, 9, 10, 14
media, 6, 15
modesta, 5, 6, 15
montana, 11
nigrior, 15
nigrita, 13
obscura, 15
oslari, 4, 11
patruela, 14, 137
perviridis, 11
ponderosa, 13
punctulata, 4, 8, 16
puritana, 8, 16, 18, 296
purpurea, 6, 10, 12, 14
repanda, 4, 12, 13, 18, 142, 212
rugifrons, 5, 6, 15, 18, 19, 296
rufiventris, 7, 10, 14, 15
saulcyi, 6, 15
scabrosa, 15
scutellaris, 15
semipicta, 6, 15
sexguttata, 4, 6, 7, 14, 18, 19, 296
silvatica, 11
spreta, 12
striga, 15
togata, 16
tortuosa, 15
tranguubarica, 4, 8, 14, 203
transversa, 12, 13
unicolor, 15, 142
unipunctata, 14, 19, 296
venusta, 15
vestalia, 11, 206
vulgaris, 18, 142
vulgaris minor, 4, 14
Cicones lineaticollis, 120
Cirrhophanus triangulifer, 140

- Cirtus aurantium, 55
 Cladura, 36, 37
 flavoferruginea, 36, 37, 38, 39
 fuscata, 36
 indivisa, 36, 37, 38
 Clematis ligusticifolia, 57
 Cleone serrulata, 54
 Cleora agrestaria, 290
 glaucaria, 291
 lixaria, 292
 Cleruchus, 43
 Clerus quadriguttatus, 221
 Clinodiplosis, 144, 147
 arancosa, 154
 caulicola, 154
 Clisiocampa americana, 57
 dissimilis, 57
 Cnemodes mavortius, 121
 Cnemidotes, 162, 172
 callosus, 173
 cæsus, 173
 duodecimpunctatus, 173, 174
 edentulus, 174
 festivus, 177
 muticus, 176, 183, 186
 pedunculatus, 175
 simplex, 174
 Cnephalodys, 113
 Cnephalia, 113, 114
 Cnephomyia floridana, 113
 Coccidomyia *crii*, 147
 pennsylvanica, 147
 Coccinella undecimpunctata, 217
 Cœnus delius, 53
 Colias, 217
 Collops, 220, 249
 argutus, 269, 270
 aulicus, 260
 balteatus, 255, 268, 273
 bipunctatus, 255, 263, 272
 claricollis, 252, 260
 confluens, 253, 254, 272
 cribosus, 251, 255, 256, 269
 crusoei, 254, 255, 269
 discretus, 252, 261
 dux, 252, 259
 eximius, 259, 262, 263
 femoratus, 255, 256, 272
 flavicinctus, 253, 264
 floridanus, 252, 262, 263
 georgianus, 253, 264
 gracilis, 253, 265
 hirtellus, 252, 261
 histrio, 255, 254, 269, 270, 272
 insulatus, 255, 268, 270, 274
 laticollis, 253, 265
 limbatus, 251, 264
 Collops limbellus, 253, 264
 lucens, 252, 261
 marginellus, 253, 264, 266
 marginicollis, 252, 259, 260
 necopinus, 251, 252, 254
 nigriceps, 252, 262, 263, 267
 nigritus, 251, 252, 259
 parvus, 251, 256
 pulchellus, 254, 268, 269, 270, 272
 punctatus, 251, 252, 256, 258, 263
 punctulatus, 254, 267
 quadrimaculatus, 255, 269, 270,
 272
 reflexus, 252, 260
 scutellatus, 254, 268, 270
 similis, 254, 270
 subænus, 252, 262
 sublimbatus, 251, 253, 258, 264
 subtropicus, 252
 texanus, 255, 268
 tibialis, 253, 254, 270
 tricolor, 251, 253, 256, 257, 258,
 263, 264
 utahensis, 255, 268
 validus, 254, 268
 versatilis, 253, 255
 vicarius, 251, 257, 258
 vittatus, 253, 254, 265, 266, 267,
 272
 Colpodes ethlius, 70
 Compsilura, 111
 Conocephalus ensiger, 122
 Conotrichelus anaglypticus, 121
 Contarinia coloradensis, 240
 Copipanoles cubilis, 222
 Coquillettonyia, 144, 147
 dentata, 145, 147, 155
 knabi, 154
 Corinthomyia *gracilis*, 102
 Corixa femorata, 92
 Corymbites cylindriformis, 221
 Corynocoris typhaeus, 294, 303
 Cosmopepla carnifex, 54
 Cosymbia myrtaria, 284
 Cremastogaster, 31
 arizonensis, 130, 132, 133
 biroi, 45
 Crepidodera rufipes, 221
 Crioceris nubilus, 121
 Crioprosopus, 208, 209
 magnificus, 208
 Criorhina verbosa, 221
 Cryptopristus, 276
 Cuterebra horripilum, 140
 Cyphrus andrewsii, 298
 bicarinatus, 298
 canadensis, 298

- Cyphrus elevatus*, 205
violaceus, 204, 298
Cycloneda immaculata, 208
Cyclotophrys anser, 109
Cydnus obliquus, 50
Cyllene crinicornis, 200
Cymindis cribricollis, 195
Cyphonia clavigera, 67
Cyrtosiphia, 305
- Dasycozymbia*, 283
gracilata, 283, 292
Dasyllis tergissa, 52
Dasyneura, 147
eugeniae, 106
Daucus carota, 51
Decatoma, 278
doanei, 279
gracilis, 280
kelloggi, 278
Deilinea celataria, 288
fumosa, 285
hulstii, 285
lenitaria, 284, 285
verdiaria, 285
feminaria, 288
ferruginosaria, 290
hulstii, 290
Demera, 21, 24
Dendrocoris humeralis, 55
Dendroctonus terebrans, 221
Dendroctonus quercus, 205
Derema, 24
foveicollis, 24
Diapheromera femorata, 206
veliei, 206
Dicerca lirida, 221
punctulata, 135
Dicopus, 43
Dicranomyia saltans, 145
Dicrepidius ramicornis, 120
Dicroidiplosis, 236
antennata, 243
californica, 244, 245
gillettei, 241, 244
helena, 245
populi, 245
Dineutes, 73
Dinoderus cibratus, 221
Diplacus longiflorus, 151, 152
Diplolepis echina, 281
Disholcaspis eldoradensis, 279, 280
Ditoma pinicola, 221
Dorytomus brevicollis, 221
Drepanopora, 20, 22
borboroporoides, 22
Dulichium arundinaceum, 242
- Dytiscus caesus*, 172
elevatus, 161, 178
harrisii, 200
impressus, 169
ruficollis, 162, 169
- Eccoptoglossa*, 20
obscura, 22
Eccritosia amphinoma, 296
Elaphrus cicatricosus, 74
Elasmostethus cruciatus, 58
Elasmucha lateralis, 57
Elytroleptus floridanus, 74
Encelia californica, 152
Enchenopa binotata, 59, 66
Ephydra, 77, 78, 79, 95, 96, 101
atrovirens, 99, 101
auripes, 99, 101
californica, 85, 92, 93
cinerea, 78, 81
crassimana, 85
gracilis, 78, 83, 84, 88, 89, 98, 102
halophila, 78, 93, 96
hians, 85, 88, 89, 92, 93, 98, 99,
 101
millbrae, 88, 96, 97, 98, 102
subopaca, 93, 95, 96, 97, 98, 100,
 102
tarsata, 85
viridis, 99, 100, 101
Epidexia filamentosa, 112
Epilachna borealis, 55
Epitragus arundinis, 57
Epurea erichsoni, 221
Erax, 296
Erebis odora, 68, 301
Ernobia granulatus, 121
Ernodea littoralis, 108, 112
Eriplatytmata grotearia, 292
Eristalis, 139
arbusorum, 73
latifrons, 73
tenax, 139, 220
Erium lichtensioides, 147
Erythnometus, 43
Eucallia, 2
Euceromasia spinosa, 112
Eucheira socialis, 202
Eucyrtus johnsoni, 54
Euemera angularia, 292
Eugenia buxifolia, 106
Eugonia J-album, 217, 218
Eupelmus hirtus, 54
Euproctoporus, 2
Eurycotis floridana, 121
Eurygaster alternata, 49

- Eurymus anthyale, 217
pilodice, 217
- Eurytoma, 277
incerta, 277
querrei, 278
- Euschistus fissilis, 52
ictericus, 53
politus, 52
tristigmus, 52, 57
variolarius, 53
- Euthamia, 113
- Eutheresia monohammi, 117
- Enthyatira pudens, 142
- Euzenilla aurea, 111
- Everes comyntes, 211
- Exorista, 109, 112
- Exochomus arizonica, 68
scapularis, 68, 208
- Falagria, 20, 22, 26
angulata, 26
dissecta, 26
iowana, 26
ithacana, 26
sterilis, 26
subsimilis, 26
suleata, 23
texana, 26
- Falagriola, 24, 27
- Falagrioma, 24, 27
- Falagriota, 20, 26
asperula, 26
collaris, 26
evanescens, 26
lucida, 26
occidua, 22
parvipennis, 26
picina, 26
- Feltiella, 155
- Feralia jocosa, 219
- Fitchia nigrovittata, 222
- Formica cinerea, 35
- Frühstorferia sexmaculata, 141
- Galeruca, 55
- Galerucella luteola, 57
- Geotrupes egeriei, 195
- Geotrupes splendidus, 194, 195
- Glena texanaria, 216
- Gossypium, 55
- Grapta, 217
- Grindelia robusta, 149
- Gryllus rubens, 121
- Hæmatopsis, 196
- Haliplus, 157, 158, 159, 161, 162, 182,
 190, 191, 193
- Haliplus americanus, 169
borealis, 163, 167, 168
concolor, 163, 164
connexus, 163, 164, 179, 182
cribrarius, 163, 170, 179, 182
deceptus, 163, 166
fasciatus, 163, 164, 165
immaculicollis, 169
lewisii, 163, 166
longulus, 162, 165
mimeticus, 163, 168
nitens, 163, 171
pantherinus, 169
punctulatus, 163, 167
ruficollis, 162, 169, 179, 182, 183,
 186, 188, 190, 192, 193
trispis, 163, 169, 179, 192
tumidus, 163, 171
vancouverensis, 162, 168
- Haltica chalybea, 57
- Helophorus, 220
- Helops cisteloides, 121
- Heliocheilus, 194, 222
lupatus, 193, 194
paradoxus, 193, 194
- Heliothis, 193
armiger, 194
disparea, 194
lupatus, 193
obsoleta, 57
ononis, 194
- Hemiarcus hanno, 211
- Hemileuca, 30
maia, 57
- Henicocephalus culicis, 69, 70, 207
- Hibiscus, 297
- Hirmoneura flavipes, 296
- Hister attenuatus, 120
cylindricus, 120
parallelus, 120, 221
- Hydrophilus, 217
ater, 217
insularis, 217
triangularis, 217
- Hylobius pales, 121, 221
- Hydriceps glabratus, 221
- Hymenarcys nervosa, 53
- Hyperaspis connectens, 208
- Hyphantria cunea, 57
- Hypophloeus glaber, 121
thoracicus, 121
parallelus, 221
- Ips avulsus, 121
- Iris versicolor, 52, 53
- Ischnoptera, 121

- Itonida aphidivora, 245
aprilis, 247
inops, 247, 248
putrida, 246
resinicola, 247, 248
sanguinea, 247
setariæ, 247
- Janetiella americana, 149
coloradensis, 148
nodosa, 149
- Jodia rufago, 222
- Johnsonomyia, 102
cincta, 103
- Juniperus utahensis, 148
- Karschomyia *towensendi*, 155
viburni, 156
- Lachnosterna, 214
- Lactica iris, 298
- Laemophlebus adustus, 221
biguttatus, 221
convexus, 221
- Lasconotus pusillus, 120
referendarius, 120
- Lasioptera *diplici*, 151
hecate, 150
verbenæ, 149
- Lathrodetes, 200
- Lecanium phoradendri, 131, 132
- Lema solani, 298
- Lepidium virginicum, 53
- Leptagria, 24, 27
peregrilis, 24, 27
- Leptinotarsa *decemlineata*, 55, 56, 57
- Leptomeris plantaginaria, 284
- Leptostylus arcuatus, 121
- Leptura abdominalis, 206
- Lestodiplosis, 242
- Lestremia, 237
- Leucobrephis, 196
brepoides, 196
- Libellula *incesta*, 68
- Limnetes, 216
astyanax, 205
ursula, 57
- Limnophila, 37
- Lina lapponica, 202
scripta, 202
- Lissagria, 21, 23, 26
fissilis, 26
impressifrons, 26
laeviuscula, 23, 26
longicollis, 26
miniuscula, 26
robusta, 26
- Litargus *sexpunctatus*, 221
- Lophagria, 20, 21
- Lorinota, 21, 25, 27
acomana, 27
arizonica, 27
bilibimba, 27
caviceps, 27
cingulata, 23
fontinalis, 27
gracilis, 27
parva, 27
pinalica, 27
sinnuosa, 217
tenuicornis, 27
- Lozogramma nigroseriata, 286, 288
- Lycena argus, 35
corydon, 32, 35
fulla, 31, 33
lucia, 222
marginata, 222
piasus, 31, 32, 33, 36
pseudargiolus, 35, 222
sonorensis, 31
violacea, 222
- Lygaeus albulus, 134
costalis, 210, 211
enotus, 211
kalmii, 210, 211
melanodermus, 211
reclivatus, 210, 211
turcicus, 210, 211
- Macaria infimata, 286
puertata, 286
- Mamestra marinitincta, 140
- Mantoida major, 202
- Masicera, 112
paucisetata, 112
- Mecoceras, 196
- Melagria, 24, 27
- Melanophthalma pumila, 221
- Memythrus palmii, 142
- Meneclis insertus, 54, 57
- Merodon equestris, 139
- Merope tuber, 203
- Metatropiphorus belfragei, 134
- Miastor, 300
- Michtyosoma heterodoxum, 213
- Microcerata, 236, 237
- Microdon tristis, 220
- Milyas cinctus, 222
- Mineus stigipes, 56
- Mongoma pennipes, 145
- Monocrepidius auratus, 120
bellus, 120
- Monohammus, 119
confusor, 117

- Monohamnus titillator, 121
 Monomorium destructor, 45
 floricola, 45
 Mormidia lugens, 52
 Muogeotia, 189
 Murgantia histrionica, 54
 Musca, 114, 118, 119
 Myas coracinus, 195
 Mydas cleptea, 296
 Myrmecocephalus, 21, 24, 25
 fauveli, 25
 Myrmecophila pergandei, 141
 Myodites fasciatus, 292

Nausibius repandus, 120
Necrophorus marginatus, 194
 tomentosus, 194, 195
Necydalis mellitus, 213
Nematus erichsonii, 57
 ventricosus, 56
Nemognatha cribaria, 140
Nemosoma parallelum, 120
Neocatocha, 236
 marilandica, 236
Neptunimyia, 236
 tridens, 237
Neothelaira dixina, 109
Neottiglossa undata, 53
Neurocordulia obsoleta, 141
Neuroctenes simplex, 222
Neuroterus saltatorius, 293
Nezara hilaris, 55
 pennsylvanica, 55
Notoiphilus leucostigma, 51
Notonecta unifasciata, 92
Notoxus monodon, 221
Nitella, 179, 182, 183, 186, 190, 192

Odontochila, 2
Odontomachus haematoda, 45
Odontonyx trivittis, 140
Oeneis semidea, 217
Oligarces, 300
Oligosthenus, 281
Oligotrophus betheli, 148
 betulae, 148
Onus, 5, 10
Onagra biennis, 53, 57
Onthophagus, 305
 nuchicornis, 223, 303
Oophilus, 43
Ophirion, 115
Ormyrus, 276
 distinctus, 276
Orocharis grylloides, 121
Orsodachna vittata, 221
Orthagria, 21, 25

Otidocephalus, 131, 133
Otomasicera patella, 113
Oxychila, 2
Oxygonia, 2
Oxynops serratus, 110

Pachnobia salicarum, 142
Pamphila arpa, 217
 ethlius, 206
 floridae, 217
 striga, 217
Panagaeus fasciatus, 140
Pangaeus bilineatus, 50
Panicum setaria, 52
Paota, 196
Papaipema mocsari, 138
 impecuniosa, 138
 delineata, 138
Papilio aristochiae, 74
 asterias, 55, 217
 cresphontes, 216
 hector, 74
 homerus, 297
Papiopolytes, 74
Paranagrus, 40
Peltodytes, 157, 158, 159, 161, 172,
 178, 182, 186, 189, 190, 191,
 193
 callosus, 173, 174
 duodecimpunctatus, 173, 174, 177
 edentulus, 173, 174, 179, 184,
 188, 192, 193
 festivus, 173, 177
 floridensis, 173, 177
 litoralis, 173, 178
 muticus, 173, 176, 177, 179, 188,
 192, 193
 pedunculatus, 173, 175
 simplex, 173, 174
Peribalus limbolarius, 51
Perilloides circumcinctus, 56
 exaptus, 56
Pero marmoratus, 214
 morrisonatus, 214
Petrophora rubrosuffusa, 282, 283
Phasiopsis floridana, 108
Phasiopteryx, 119
 bilimeki, 114, 116
 montana, 114, 116, 117
Phedole, 45, 46
 javana, 45
Phenacoccus acericola, 244
Phleosinus dentatus, 221
Phoberia atomaris, 222
Phoradendron flavescens, 130
 villosum, 133

- Phoradendron formicarii, 134
 missionum, 133
 Phymata vicina, 134
 Phytophaga ulni, 240
 Pieris, 218
 rapae, 57
 Piezostethus sordidus, 121
 Pinus monophylla, 29
 palustris, 119
 ponderosa, 29
 scapularum, 241
 virginiana, 149
 Pissodes strobi, 221
 Pityophthorus concentralis, 121
 Plagiolepis longipes, 46
 Plagiomimicus pityochromus, 140
 Plagiops litoralis, 107
 meridionalis, 108
 Platydema flavipes, 121
 Platynus caudatus, 140
 Platysoma lecontei, 221
 Platythyrea, 44
 Plegaderus transversus, 221
 Pluchea camphorata, 294
 Plusiotis, 207
 beyeri, 208
 gloriosa, 208
 lecontei, 208
 woodi, 208
 Podisus cynicus, 57
 maculiventris, 56, 52
 modestus, 57
 placidus, 57
 sericeiventris, 57
 Polygonia faunus, 217, 218
 gracilis, 217
 progne, 217, 218
 Polynema, 40, 41, 42
 bifasciatipenne, 40, 41
 reduviola, 41
 Polyleurus nitidus, 210
 Ponera schauinslandi, 44
 Pontia napi, 218
 oleracea, 218
 Populus grandidentata, 141
 tremuloides, 245
 Porricondyla dietzii, 105
 dorsata, 238
 flava, 239
 juvenalis, 239
 orrecta, 105
 tuckeri, 105
 vernalis, 105
 Porthetria dispar, 54, 57
 Prenolepis burbonica, 46
 fullawayi, 46
 imparis, 31
 longicornis, 46
 minutula, 46
 Prepupa, 2
 Pristophora glossularia, 57
 Proctacantha nigritiventris, 300
 Procula douei, 208
 Protodexia synthetica, 117
 Psammoeus desjardinsi, 120
 Psaphidia resumens, 222
 Pselliapus barbari, 217
 cinctus, 217
 Pseudococcus phoradendri, 131, 133
 Pseudoscopaeus, 21, 25
 Pseudoterpnia pruinota, 290
 Pseudoxychila, 2
 Psychomorpha epimensis, 218, 219
 Psyllobora nana, 208
 nigrovittata, 208
 Ptelea trifoliata, 60
 Pterostichus acutus, 298
 Pulvinaria innumerabilis, 53
 Purpuricenus, 209, 213
 humeralis, 213
 Pyraneis atalanta, 293, 294
 Pyrophila pyramidoides, 57
 Pyrrhotes hematoloma, 134
 Pyxidanthera barbulata, 19
 Quercus, 55
 catesbeii, 193, 305
 chrysolepis, 278, 279
 douglasii, 275, 276, 281
 dumosa, 275, 277, 280
 emoryi, 130
 rubra, 57
 Rhagium lineatum, 221
 Ranunculus, 54
 Reduvius pallescens, 222
 Rhabdophaga aceris, 239
 rileyana, 240
 Rhinomacer pilosus, 221
 Rhizophagus cylindricus, 221
 Rhus glabra, 56
 Rhymbus minor, 215
 ulkei, 215
 Rhynchocephalus sackenii, 296
 subnitens, 296
 Robinia, 60, 61
 Sacium lunatum, 221
 Salix tristis, 19
 Sambucus canadensis, 52
 Sandalus petrophya, 140
 Sardiocera valida, 117
 Satyrus, 218
 Scopelosoma moffatiana, 222

- Serophularia nodosa*, 54
Seymnus, 208
 myrmedon, 120
Selandria barda, 57
Selenophorus iripennis, 120
Selidosoma, 214
 æthalodaria, 291
 inconspicua, 290, 291
 wrightiaria, 290, 291
Serica, 298
 iricolor, 221
Sericosema angulata, 288
Sesia sigmoidea, 200
Silvanus bidentatus, 120
 imbellis, 120
Sinoxylon basilare, 292
Solanum, 245
Solenopsis geminata, 121
 rufa, 45
Solidago, 51, 57
Solubea pugnax, 52
Soronia decumana, 134
Spallanzania hebes, 114
Spathidexia, 115
 clemensi, 110
Sphaeridium bipustulatum, 68, 203, 223
 quadrimaculatum, 69
 scarabeoides, 69, 203
Sphaerophora cylindrica, 139
Spharagemon scudderi, 19
Spirogyra, 189
Spongosphorus, 65
Stamnodes albiapicata, 283
 gibbicostata, 283
Statira croccicollis, 140
Stenagria, 20, 23
 gracilipes, 23
Stenotrachelys approximaria, 216
Stephanoderus, 131
Stephanodes, 40, 43
 elegans, 40, 41
 pscas, 41
Stethaulax marmoratus, 49
Stethynium, 43
Stilicioides, 25
Stiretrus anchorago, 55
Symbiotes duryi, 215
Synelys subquadrata, 216
 timandrita, 216
Synomila, 196
Syntomaspis, 274
 carulea, 275
 californica, 274
Syrphus, 139
Systropus, 296

Tachys scitulus, 120
Tæniocampa subterminata, 222
Tanymecus lacena, 121
Tapinoma melanocephalum, 46
 sessile, 31
Technomyrmex albipes, 46
Telenomus ashmeadi, 54
 podisi, 57
Temnochila acuta, 209
 area, 209
 chlorodia, 193, 194, 209
 nyenta, 209
 virescens, 194, 209
Tenebrioides collaris, 120
Tephrosia fautaria, 287
 ferruginosaria, 288
 nigroseriata, 288
 virginica, 19
Tetracha, 2, 208, 209
 virginica, 19, 296
Tetrachis hyperborea, 287, 288
Tetramorium guineense, 46
Tetrastichus, 280
 pattersonae, 280
 stanfordiensis, 281
Tetyra bipunctata, 48
Thallophaga, 287
 fautaria, 287, 288
Theogonis phyllopus, 54
Thecla angustus, 222
 arota, 211
 calanus, 211
 clytie, 212
 halesus, 131
 ines, 212
 irus, 222
 itys, 211
 leda, 212
 niphon, 222
 phœbe, 140
 regalis, 140
Thecodiplosis ananassi, 242
 dulichii, 241
 hudsonici, 153, 242
 mossellana, 242
 zauschneriae, 152
Thelairodes cinereicollis, 110
Theresia analis, 117
 tandrec, 117
Thermopsis, 53
Thyanta calceata, 54, 58, 138
 custator, 54
Tilia americana, 55
Tipula albimana, 225, 233
 breviventris, 225, 230
 dispellens, 225, 228
 pictipes, 225

- Tipula similis*, 225, 232
 unicolor, 225
Tomarus pulchellus, 221
Tomicus, 121
 calligraphus, 221
Torymus, 152
Toxotus vittiger, 212
Tragidion coquus, 215
Tragosoma, 213
 depsarium, 213
 harrisi, 213
 pilosicollis, 213
Trechus chalybeus, 300
Trichius delta, 140
Trichopepla semivittata, 51
Tricyphona inconstans, 40
Triglyphothrix obesa, 46
 australis, 46
Trirrhabda tomentosa, 56
Trissolcus brochymenæ, 50
 euschistus, 52
 murgantiae, 54
 podisæ, 54, 57
 thyantæ, 54, 57
Tritozyga, 237
Trogosita, 296
 nyenta, 71
 virescens, 70, 71, 102, 296
Tropisternus, 306
 dorsalis, 306
 lateralis, 306
Tropisternus striolatus, 306
Tyrus humeralis, 221
Ulomorpha, 37
Utetheisa bella, 137
 ornatrix, 137
Valgus squamiger, 221
Vanessa milberti, 73
Verbascum, 52
 blattaria, 52, 53, 54
Verbena prostrata, 150
Vespa maculata, 301
Viburnum, 59, 60, 61
Volucella obesa, 139
Voria, 108
Winthemia quadripustulata, 109
Xanthogramma emarginata, 220
Xanthonia decemnotata, 221
Xyleborus, 131
Xylotrechus sagittatus, 121
Xyloryctes satyrus, 205
Youngomyia pennsylvanica, 106
Zauschneria californica, 153
Zea mays, 52, 53, 54
Zelus rubidus, 296
Zelima nigra, 221
Zygenma, 189

THE
NEW YORK ENTOMOLOGICAL SOCIETY.

Organized June 29, 1892.—Incorporated June 7, 1893.

The meetings of the Society are held on the first and third Tuesday of each month (except June, July, August and September) at 8 P. M., in the AMERICAN MUSEUM OF NATURAL HISTORY, 77th Street and Eighth Ave.

Annual dues for Active Members, \$3.00.

Members of the Society will please remit their annual dues, payable in January, to the treasurer.

Officers for the Year 1912.

President, RAYMOND C OSBURN . . . Columbia University, New York.

Vice-President, CHAS. L. POLLARD New Brighton, Staten Island, N. Y.

Secretary, CHAS. W. LENG 33 Murray St., New York.

Treasurer, WM. T. DAVIS 46 Stuyvesant Place, New Brighton,
Staten Island, N. Y.

Librarian, JOHN A. GROSSBECK American Museum of Natural History,
New York.

Curator, FRANK E. LUTZ. . . American Museum of Natural History, New York.

EXECUTIVE COMMITTEE.

G. W. J. ANGELL, CHAS. W. LENG, E. G. LOVE,
CHAS. E. SLEIGHT, H. G. BAREER.

PUBLICATION COMMITTEE

F. E. LUTZ,
W. M. WHEELER,
C. SCHAEFFER.
R. C. OSBURN.

AUDITING COMMITTEE.

C. F. GROTH, E. L. DICKERSON, E. D. HARRIS

FIELD COMMITTEE

JOHN A. GROSSBECK,
G. P. ENGELHARDT,

DELEGATE TO THE N. Y. ACADEMY OF SCIENCES

E. B. SOUTHWICK.

Price List of Entomological Publications

For Sale by the New York Entomological Society.

- LINELL, MARTIN L. A short review of the Chrysomelas of North America. 5 pp. 15c.
- CASEY, THOS. L. Studies in Ptinidæ, Ciodidæ, and Sphindidæ of America. 32 pp. 75c.
- A revision of the North American Coccinellidæ. 98 pp. \$1.50.
- Review of the American Corylophidæ, Cryptophagidæ, Tritomidæ and Dermestidæ, with other studies. (Cuts) 121 pp. \$2.00.
- FALL, H. C. Synopsis of the species of Acmaeodera of America, north of Mexico. 36 pp. 75c.
- On the affinities of the genus Tachycellus with descriptions of new species. 10 pp. 20c.
- LENG, CHARLES W. Notes on Coccinellidæ, I, II. 31 pp., 3 pl. \$1.00.
- SCHAEFFER, C. Synopsis of the Species of Trechus, with description of a new species. 4 pp., 1 pl. 20c.
- WICKHAM, H. F. The North American species of Cotalpa. 4 pp. 10c.
- Fox, WILLIAM J. Synopsis of the species of Nysson, inhabiting America north of Mexico. 7 pp. 20c.
- COQUILLETT, D. W. Synopsis of the dipterous genus Symphonia-myia. 4 pp. 10c.
- Revision of the dipterous family Therevidæ. 6 pp. 15c.
- NEUMOEGEN and DYAR. A preliminary revision of the Bombyces of America north of Mexico. \$1.50.
- DYAR, HARRISON G. A review of the North American species of Pronuba and Prodoxus. 3 pp. 10c.
- A revision of the Hesperiidæ of the United States. 32 pp. 60c.
- Synoptic table of North American mosquito larvæ. 5 pp. 10c.
- The North American Nymphulinae and Scopariinae. 31 pp. 55c.
- DYAR, H. G., and KNAB, FREDERICK. The larvae of Culicidæ classified as independent Organisms 61 pp., 13 pl. \$1.50.
- KEARFOTT, W. D. Revision of the North American species of the genus Choreutis. 20 pp. 50c.
- CAUDELL, A. N. The genus Sinea of Amyot and Serville. 11 pp., 1 pl. 35c.
- The Cyrtophylli of the United States. 13 pp. 1 pl. 40c.
- BUENO, J. R. DE LA T. The Genus Notonecta in America North of Mexico. 24 pp., 1 pl. 60c.

The above papers will be sent on receipt of price by

JOHN A. GROSSBECK,

Librarian, New York Entomological Society,

**American Museum of Natural History,
NEW YORK.**

J455



1912 | AU
vol. 20 | TIT
1912 | 1912

R. H. Maud

GPO 10-6159

SMITHSONIAN INSTITUTION LIBRARIES



3 9088 00833 6273